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Final Supplemental Environmental Impact Statement

on Management of Habitat for
Late-Successional and Old-Growth
Forest Related Species Within the
Range of the Northern Spotted Owl

Appendix J2

Results of Additional Species Analysis



Appendix J2

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Appendix J of the Final SEIS Methods of Additional Species Analysis for the Final SEIS

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Appendix J2

Methods of Additional Species Analysis for the Final SEIS

Introduction and Objectives

Additional analysis was conducted, between the Draft and Final SEIS, on many of the late-successional and old-growth related species within the range of the northern spotted owl. While the analysis was focused on responding to public comments on the preferred alternative (Alternative 9), much of it is also pertinent to the other nine alternatives.

The additional analysis had the following objectives:

- Identify species for which additional consideration and analysis is appropriate;
- Generate additional information on the impacts of activities on nonfederal lands and other sources of cumulative effects;
- Explain, in more detail, the basis for the ratings provided in the Forest Ecosystem Management Assessment Team (FEMAT) Report (Appendix A) and Draft SEIS for selected species; and
- Provide detailed specifications of mitigation measures that could be employed, and the relative benefits and costs of implementing those measures.

Because the original species assessments were done by the Assessment Team, original members were asked to provide additional analysis. Wherever possible, the Assessment Team member who originally dealt with a specific taxon was asked to provide the additional input for that taxon. In a few instances, assignments had to either be shifted, or new species experts recruited, to deal with a specific taxon. The group that completed this additional analysis is hereafter referred to as the Species Analysis Team in order to distinguish it from the original Assessment Team. The individuals who contributed to this analysis are listed in the front of this Appendix.

Wherever possible, information was sought from individuals who had participated in the original assessment panels. The assessment panels themselves, however, were not reconvened. The judgements reported here are not the result of the formal expert opinion process used during the Assessment Team's efforts. Instead, they reflect the judgements of the Species Analysis Team. These judgements were based on information contained in the FEMAT report, individual knowledge, and consultation with some individual species experts.

Description of the Process

The process had six main steps:

Step 1: Screen Species for Further Analysis

To identify species for further analysis, four separate screens were used. Although applicable laws were considered in the development of these screens, it is important to note that the screening levels do not represent a judgement about what is required by either the National Forest Management Act (NFMA) or the Endangered Species Act (ESA). Use of the screens was intended to produce a list of species for which further investigation might prove useful or necessary.

Screen #1 - Species screened based on their rating in the FEMAT Report - The first screen was to identify those species for which additional analysis might be useful in light of the original assessment they received. The following screening levels were adopted:

- For vertebrates, reexamine all species with a likelihood of Outcome A of less than 80 percent, or any percent likelihood of Outcome D.
- For all other taxa, reexamine all species with a combined likelihood of Outcomes C and D of 20 percent or more, or any percent likelihood of Outcome D.

Outcomes A, B, C, and D refer to the system that was used for the original species ratings. These outcomes were intended to describe the amount, quality, and distribution of habitat that would be provided for each species. The outcomes were defined as:

- A Habitat is of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across federal lands. (Note that the concept of well distributed must be based on knowledge of the species distribution, range, and life history).
- B Habitat is of sufficient quality, distribution, and abundance to allow the species population to stabilize, but with significant gaps in the historic species distribution on federal land. These gaps cause some limitation in interactions among local populations. (Note that the significance of the gaps must be judged relative to the species distribution, range, and life history, and the concept of metapopulations).
- C Habitat only allows continued species existence in refugia, with strong limitations on interactions among local populations.
- D Habitat is inadequate to maintain the species and would result in species extirpation from federal land within the range of the northern spotted owl.

Screen #2 - Species screened considering post-Draft SEIS changes to Alternative 9 - Several features of Alternative 9 were expected to change due to public and internal comment. Some species that would otherwise have passed the FEMAT-rating screen were considered because of these expected changes.

Screen #3 - Species screened based on cumulative effects - The ratings done by the Assessment Team were based on the management of habitat on federal lands under the different alternatives. The Assessment Team and panelists did not explicitly evaluate cumulative effects including habitat conditions on nonfederal lands, other threats to the species population on nonfederal lands, or other influences such as hunting, trapping, or water quality resulting from non-federal actions. Species were identified for further analysis if they were potentially adversely affected by cumulative effects. In order to determine if any species required further analysis due to cumulative effects, the Species Analysis Team asked three primary questions. (1) Would the outcome for the total species population differ from the outcome projected in the FEMAT Report which was based only on habitat management of federal lands? (2) Would cumulative effects create a risk of extirpation of any species from federal land that was not projected as being at risk in the FEMAT Report? (3) Would cumulative effects contribute significantly to a risk of extirpation of any species from federal land that had already been projected as being at risk in the FEMAT Report? If such effects were foreseen for any species, that species was added to the group that was to be further analyzed.

Screen #4 - Species screened based on additional species-specific criteria - Some species that did not meet the above guidelines were selected for further consideration. For example, a species on a Regional Forester's sensitive list could be subject to additional analysis even though the species did not specifically meet the above criteria.

Based on the screening process, 486 species and 4 groups of insects were identified for additional analysis (Table J2-1). This included northern spotted owls and marbled murrelets for which additional analysis was done based on issues raised in the Draft Biological Opinion.

Table J2-1. Comparison between species/ranges/groups assessed in the FEMAT Report and those for which additional analysis was done.

Species group	Species/ranges/groups assessed in FEMAT	Species/ranges/groups in additional analysis
Bryophytes	106	9
Fungi	527	255
Lichens	157	75
Vascular plants	124	17
Arthropods (groups or ranges)	15	4
Mollusks	102	97
Amphibians	18	12
Fish (races/species/groups)	7	7
Birds	36	2
Bats	11	7
Other mammals	15	3
Northern spotted owls	1	1
Marbled murrelets	1	1

Total

1120

490

Step 2: Describe in Detail the Basis for the Original Species Rating, and/or the Basis for Concern About Cumulative Effects

For each of the species selected in the above screens, a detailed description and interpretation was provided of the basis for the species rating in the FEMAT report, the basis for reassessment given proposed changes to Alternative 9, and/or the basis for concern about cumulative effects. In the process of completing these descriptions, original assessment panel notes were consulted, as well as detailed maps of Alternative 9 and of species' ranges and locations; original literature sources for the species; and information on the portion of the species' range and/or locations included within reserves. Updated information was sought from State Natural Heritage Program data bases, and new herbarium searches were conducted for lichens.

The additional analysis for some species was more detailed than the original assessment, and/or included new information that was not reasonably available at the time of the original assessment. In some cases, this additional information provided the basis for reinterpreting the assessments in the FEMAT Report. Where this occurred, it is noted in the species discussions later in this appendix.

In developing the detailed descriptions of the species' rating, the Species Analysis Team considered the contribution that each of the following factors may have made to the original rating.

- **Natural History** - In some cases, the species may be known from only a few sites or from within a very limited distribution. In other cases, the species habitat, and thus its distribution, may be naturally fragmented.
- **Past Actions** - In some cases, the species' habitat has been severely impacted and/or fragmented by previous actions, and can only recover slowly. In other cases, the species has already been extirpated from significant parts of its range, and recolonization is problematic.
- **Species' Range** - A large portion of a species' range may lie outside the range of the northern spotted owl. In other cases, a large portion of a species' range may occur on nonfederal land.
- **Non-habitat Factors** - Factors such as hunting, fishing, air and water quality, and climate can influence the likely future for some species.
- **Inadequate Information** - In some cases, the species' rating may be largely a reflection of scientific uncertainty due to the lack of available information about a species.
- **Features of the Alternative** - The specific features of the alternatives were intended to play a primary role in determining the species' rating. For this analysis, the Species Analysis Team attempted to detail the specific features of the alternative that most influenced the original rating. This information was a critical building block for designing mitigation measures.

In addition to the above factors, the possible role of cumulative effects was examined for each species in this analysis. This included species that were specifically analyzed because of cumulative effects, as well as species that were analyzed based on other screens. The Species Analysis Team assessed the role that cumulative effects might play in determining the species' future, and whether cumulative effects had already been accounted for in the FEMAT rating. Even though the original Assessment Team ratings of habitat outcomes for federal land were supposed to be independent of cumulative effects, in practice it was very difficult to separate federal habitat from other influences on some species. In this most recent analysis, discussions of cumulative effects include the effects of species' range, non-federal habitat management, and non-habitat factors.

Based on the above discussions, a summary statement was provided describing the likely future outcome for each species. This summary provided clarification of the reasoning behind the species rating in the FEMAT Report. The summaries enabled the Species Analysis Team to distinguish between situations, for example, where a species received a particular rating because of naturally fragmented habitat, and situations where a species received a particular rating because the proposed action in the alternative was likely to further fragment its habitat. The summaries also provided new information on cumulative effects and likely effects of changes that had been proposed to Alternative 9.

Step 3: Describe Possible Mitigation Measures

Possible mitigation measures were developed in conjunction with individual species experts. The mitigation measures were designed primarily to modify features of Alternative 9, but any or all of these mitigation measures could be combined with any of the alternatives. In many cases, the possible measures are simply components of other alternatives in which the species outcome rated higher. In other cases, the mitigation measure would prescribe actions to be taken when very localized actions are planned. These mitigation measures were intended to address the rare and narrowly-distributed species. Finally, some mitigation measures were intended to offset the possible negative consequences of cumulative effects.

In all cases, the overall objective of possible mitigation measures was to bring the species to a point where it would pass through all the screens described in Step 1, above. In some cases, this objective was either not possible, or could only be accomplished by adoption of another alternative. In these cases, that conclusion is stated, but possible mitigation measures have been presented that would provide some benefit to the species. Mitigation measures have been described as specifically as possible to help determine the benefits of the mitigation.

Step 4: Describe the Benefits of the Possible Mitigation

Benefits of the possible mitigation measures would have been best described by conducting a new species assessment using a similar process as that described in the FEMAT Report. However, a number of factors prevented such a reassessment. Instead, the Species Analysis Team provided qualitative statements about the efficacy of mitigation that was proposed for each species. Wherever possible, information was provided on the effectiveness of each component of the mitigation. For example, if species surveys are an important component of the mitigation measures, the reliability of those surveys in locating the species is described. Where several different possible levels of mitigation are proposed, the benefits of each of them is described individually.

Step 5: Summarize Mitigation Measures for All Species

When work on individual species had been completed, mitigation measures for all species were summarized and combined. In many cases, mitigation measures that had been described for one species or one group of species proved appropriate for other species. Thus, after reviewing all the possible mitigation, the Species Analysis Team developed a consolidated list of 23 possible mitigation measures that encompassed all measures that had been described for individual species. This list is presented in Table J2-2. Chapter 3&4 contain more complete descriptions of measures that were incorporated into Standards and Guidelines for Alternative 9.

Table J2-2. Consolidated list of possible mitigation measures that were described for all species. The mitigation measure numbers correspond to their discussion in the text.

Survey and Manage Measures

1. Survey to acquire additional information and ascertain levels of protection. Species intended to benefit from this mitigation measure are arthropods, fungi, bryophytes, lichens, and mollusks. These groups of species are particularly poorly known. Many species have likely not yet been identified, and there is only general information available on the abundance and distribution of some known species. The information gathered through these efforts would be useful in refining the selected alternative to better provide for these species as part of the adaptive management process.
2. Survey for the species and manage individual sites where it is found. The "survey and manage" mitigation measure would have primary benefits to amphibians, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropods. Measures to survey for species and manage newly discovered sites would be phased-in over a somewhat longer timeframe than the measures to manage currently known sites.
3. Manage currently known locations of the species. Standards for management (including protection of sites) of currently known locations are discussed in individual species writeups.

Riparian Reserves

4. Survey for the species, and apply Riparian Reserve Scenario 1 guidelines along intermittent streams and small headwaters where the species is found. Prior to land management activities, conduct surveys for stream-dwelling amphibians (Black Salamander, Cascade and Southern Torrent Salamanders, Cope's Giant Salamander, and Tailed Frog) and one vascular plant (*Corydalis aquae*) using established stream-survey protocol for amphibians and appropriate plant sampling methods. Surveys for amphibians would be conducted within permanently flowing streams and adjacent streamside habitats outside of Tier 1 Key Watersheds, including Adaptive Management Areas. Where any of the species occur, occupied stream segments would be protected through application of Riparian Reserve Scenario I standards and guidelines from the occupied site upstream to its origin. Until surveys were completed, this mitigation would apply throughout the potential range or the specified portions of the species range indicated in the species narrative later in this appendix.
5. Apply Riparian Reserve Scenario 1 on intermittent streams with anadromous salmon or trout throughout the range of the northern spotted owl. The reserve widths for intermittent streams are intended to be interim. They may be modified after completion of watershed analysis. That analysis would take into account all species that were intended to be benefited by this mitigation measure.
6. Apply Riparian Reserve Scenario 1 on intermittent streams with anadromous salmon or trout throughout the range of coho salmon.
7. Ensure that riparian management in Adaptive Management Areas provides species protection equivalent to that of Riparian Reserves. In most cases riparian protection in

(Table J2-2. continued)

Adaptive Management Areas should be comparable to that prescribed for other federal land allocations. However, in those cases where alternate means are proposed to meet riparian objectives, those alternate means must meet objectives for management of all species.

8. Provide additional buffers around all wetlands 1/8 to 1 acre in size (to the outer edges of the riparian vegetation). For the purposes of this mitigation measure, wetlands are defined as any areas that are inundated or saturated by surface or ground water to the extent that they support a prevalence of vegetation adapted for life in saturated soil conditions.

Watershed Protections

9. Apply greater protection to Tier 1 Key Watersheds by removing all lands within them from the suitable timber base.
10. Build no new roads in Tier 1 Key Watersheds.

Matrix Management Provisions

11. Provide specified amounts of coarse woody debris in matrix management. This mitigation measure was developed specifically for fungi, arthropods, bryophytes, American marten, fisher, two amphibians, and two species of vascular plants. The objective is to provide this substrate well distributed across the landscape in a manner which meets the needs of species and provides for ecological functions. Standards and guidelines would consider appropriate coarse woody debris quantity, quality (such as species, decay stage and size distribution) and distribution.
12. Emphasize clumped green tree and snag leave in matrix management. For most species, benefits would be greatest if trees were retained in patches rather than singly. Because very small patches do not provide suitable microclimates for many of these organisms, patches should generally be larger than 1 hectare. Retained patches should be protected for multiple rotations to provide support for those organisms that require very old forests.
13. Provide additional no-harvest buffers around cave entrances. Conduct surveys of crevices in caves, mines, and abandoned wooden bridges and buildings for the presence of roosting bats, including fringed myotis, silver-haired bats, long-eared myotis, long-legged myotis, and pallid bats. As an interim measure, timber harvest would be prohibited within 250 feet of sites containing bats. A management plan would be developed for each of these sites that includes an inventory and map of resources, and plans for protection of the site from destruction, vandalism, disturbance from road construction or blasting, or any other activity that could change cave or mine temperatures or drainage patterns. The size of the buffer could be modified through this plan based on site-specific needs.
14. Modify site treatment practices, particularly the use of fire and pesticides, and modify harvest methods to minimize soil and litter disturbance. Many species of soil and litter-dwelling organisms, such as fungi and arthropods, are sensitive to soil and litter disturbance. Site treatments would be prescribed which would minimize intensive burning, unless appropriate for certain specific habitats, communities or stand conditions. Site treatments should also minimize soil and litter disturbance which may occur as

(Table J2-2. continued)

a result of yarding and operation of heavy equipment, and reducing the intensity and frequency of stand treatments.

15. Provide dispersal corridors where needed in the range of red tree voles. Dispersal corridors would consist of areas of continuous or nearly continuous canopy cover.
16. Implement landscape management controls in the matrix to provide for spotted owl dispersal. Adopt a standard guidance which would assure that spotted owl dispersal habitat is provided. In past management plans, the "50-11-40 rule" has been the guidance to meet this need. Prior to timber harvest the planning area under consideration would be analyzed to determine whether the landscape provides for owl dispersal. The mitigation would restrict harvest in those areas until they met 50-11-40.

Other Measures

17. Remove inventoried roadless areas (RARE II) from the suitable timber base. This mitigation measure would apply to those portions of inventoried roadless areas that still would qualify under the criteria used for the original inventory.
18. Retain all old-growth forests in Marbled Murrelet Zone 1, including Adaptive Management Areas. Residual stands of old-growth forest which occur in the matrix and Adaptive Management Areas in Marbled Murrelet Zone 1 would be retained. The intent of the mitigation would be to protect all potential marbled murrelet nesting habitat in the area most important to this species.
19. Provide for retention of old-growth fragments in watersheds where little remains. This mitigation measure was specifically designed to benefit many species of fungi, lichens, bryophytes, arthropods, and vascular plants, and would likely also benefit vertebrate species such as small mammals and amphibians, and various bird species. Landscape areas where little late-successional forest persists would be managed to retain late-successional patches. This mitigation would be applied in fifth field watersheds (20 to 200 square miles) which are currently comprised of 15 percent or less late-successional forest, accounting for all allocations in the watershed. Within such an area, all relict late-successional stands would be protected. In areas containing significant non-federal land, or in Adaptive Management Areas, this mitigation would be treated as a threshold for analysis rather than a strict standard and guideline.
20. Provide residual habitat areas around known spotted owl activity centers. The mitigation measure would apply to northern spotted owl activity centers that are not protected by Congressional Reserves, Late-Successional Reserves, Riparian Reserves, Managed Late-Successional Areas, or Administratively Withdrawn Areas. One hundred acres of the best northern spotted owl habitat would be retained as close to the nest site or owl activity center as possible for all known spotted owl activity centers in the matrix and Adaptive Management Areas. This would be intended to preserve an intensively used portion of the breeding season home range. "Activity center" is defined as an area of concentrated activity of either a pair of spotted owls or a territorial single owl.
21. Protect sites from grazing. This mitigation measure is designed to benefit specific mollusks, arthropods, and vascular plants (see species reports). Known and newly discovered sites of these species would be protected from grazing as needed to ensure that the local populations of the species would not be impacted.
22. Manage impacts in recreation areas to minimize disturbance to species. This mitigation measure would benefit a number of fungi and lichen species whose known locations are

(Table J2-2. continued)

predominantly within established recreation sites. The mitigation activities would be site-specific.

23. Identify species-specific measures. This category would include additional site-specific mitigation measures that would be implemented to provide for sites under the "survey and manage" mitigation component. Such measures have been identified for some of the mollusk, fungi, and lichen species. The specific measures would include protection from fire, prohibition of commercial harvesting, and protection from water impoundments and spring diversions.
-

Step 6: Describe the Benefit Provided to Each Species and/or Species Group by Each Mitigation

The final step in the process was to describe and display the level of benefit provided to each species by each of the possible mitigation measures. This involved reviewing the effect of all 23 consolidated mitigation measures on each species or group of species. The level of benefit that a mitigation measure would provide to a species was described, and these eight levels of benefit are displayed in Table J2-3. The results of this assessment for all species are shown in Tables J2-8a through J2-8k.

Table J2-3. Categories used to summarize the benefit that would be provided to each species by each possible mitigation measure. These numbers correspond to the numbers in Tables J2-8a to J2-8k.

1. It is judged that this mitigation measure would bring the species to the point where it would pass all the initial screens.
2. This mitigation measure, in combination with another measure, would bring the species to the point where it would pass all the initial screens.
3. While this mitigation measure would be beneficial, the species is still likely to fail a screen based on federal habitat management. The species would be more fully protected by another mitigation.
4. While this mitigation measure would be beneficial, the species is still likely to fail a screen based on federal habitat management. Adoption of another alternative is the only mitigation that would be fully successful to pass screens.
5. While this mitigation measure would be beneficial, the species is still likely to fail a screen based on federal habitat management, and no other alternative or mitigation would bring it to the point where it would pass the screen.

(Table J2-3. continued)

6. While this mitigation measure would be beneficial, the species is still likely to fail a screen due to influences outside the scope of this decision.
7. Mitigation would do harm to the species.

Cells that are shown as blank in the tables indicate that the mitigation measure is not applicable to the species, or is not one of the primary mitigation measures for the species, or that its effects on the species are unknown.

Summary of Findings for Each Species Group

A. Bryophytes

Overall, Alternative 9 affords fairly high protection to bryophytes. Eight bryophytes (two mosses and six liverworts) failed to pass the screens and received additional analysis. Two of these species (*Antitrichia curtipendula*, *Douinia ovata*) passed the first screen but were considered due to concerns regarding cumulative effects. One of the species (*Ptilidium californicum*) was reevaluated due to the proposed shortening of the harvest rotation length in California. Based on additional analysis, one species that failed the screen (*Thamnobryum neckeroides*) was found to occur in hardwood thickets, seepage areas, and talus slopes adjacent to but not in stands of old-growth. It was therefore considered not to be closely associated with late-successional and old-growth forests, although it would benefit from additional riparian protection.

For three species that failed to pass the screens (*Tritomaria exsectiformis*, *Marsupella emarginata* var. *aquatica*, and *Diplophyllum plicatum*), ratings were not higher in any other alternative and no mitigation measure would bring them to the point where they would pass the screens. However, several mitigation measures would benefit these three species. *Marsupella emarginata* var. *aquatica* would benefit from protection of the only site from which it is known, and which receives heavy recreational use. *Tritomaria exsectiformis* would benefit from fencing to protect known populations from livestock and recreationists. Conducting additional surveys and managing newly-discovered sites would also improve the outcome for these two species. *Diplophyllum plicatum* would benefit from measures that provide for coarse woody debris in the matrix.

Maintaining long rotations (180 years or more) in high elevation white fir forests in California was considered important for *Ptilidium californicum*. However, a combination of other measures would successfully mitigate this species. These measures would include protection of known sites, provisions for coarse woody debris and green tree retention in the matrix, provisions to retain old-growth fragments, provisions to provide 100-acre habitat areas around spotted owl activity centers, and conducting additional inventories and protecting known sites may be sufficient to raise the ratings to the point where this species would pass the screens. This species is also addressed in Mitigation Step 5 in the Scientific Analysis Team Report.

The other four species that were subject to additional analysis can be successfully mitigated. *Antitrichia curtipendula* and *Douinia ovata* would be successfully mitigated by implementation of Riparian Reserve Scenario 1. *Kurzia makinoana* would be successfully mitigated by a combination of Riparian Reserve Scenario 1, provisions for coarse woody debris and green tree leave, and provisions to retain old-growth fragments in watersheds where little remains. *Scouleria marginata* would be successfully mitigated by Riparian Reserve Scenario 1, and additional provisions for riparian management in Adaptive Management Areas.

If the proposed mitigation measures are not implemented, several species could be extirpated from portions of their ranges. *Ptilidium californicum* may be extirpated from the southern portion of its range in northern California. *Marsupella emarginata* var. *aquatica* could also be subject to extirpation. Although additional species locations may be found, protection of the only known site should be considered a high priority.

Loss of bryophyte species could influence the function of ecosystems in a variety of ways. For example, *Antitrichia curtipendula* plays a "keystone" role in mineral cycling and regulation of microclimate in the canopy. It also provides nesting sites for the marbled murrelet and red tree vole. Loss of this species or other key species of bryophytes could disrupt aspects of ecosystem function.

It is estimated that \$100,000 would be necessary to conduct inventories necessary for mitigation for this group, in addition to field surveys conducted during watershed analysis. While the bryophyte flora of the Pacific Northwest has generally been well studied, additional surveys could result in the discovery of additional undescribed taxa or identification of range extensions.

B. Fungi

In the FEMAT report, 527 species of fungi were evaluated that were determined to be closely associated with late-successional forest ecosystems. This list of species represents only a small percentage of the macrofungi that occur in late-successional forests. If microfungi were included, the list would be greatly expanded. For every group of fungi, there are many species, perhaps hundreds, in addition to those on the original list (see FEMAT Report, Table IV-A-1).

Screens

Two hundred and thirty-nine species of fungi failed to pass the four screens and were reassessed. Two hundred and fourteen of these species failed to pass the first screen, the original Assessment Team rating in the FEMAT Report for Alternative 9. In general, the ratings in the FEMAT Report corresponded with acreages and distribution of late-successional forests and management in the matrix. Sixteen species were added which failed the cumulative effects screen. One species was analyzed because of changes to Alternative 9. There were at least five other species for which the change from the 180-year rotation in California caused concerns, but they also failed the FEMAT or cumulative effects screens. Another eight species were reanalyzed with additional information not available at the time of the original rating; five of these species do not require mitigation. Fifteen species from the original FEMAT list were removed from the list based on additional information which indicated those species did not meet the criteria of being closely associated with old-growth forests. The species that were reanalyzed represent the broad spectrum of fungi that occur in late-successional forest ecosystems, including mycorrhizal, saprobic and parasitic species.

FEMAT Rating Screen

Of the 214 species which failed to pass the first screen (Assessment Team ratings in the FEMAT Report), over half were rare and/or locally endemic fungi. For many of these species, the ratings reflect inherent life history characteristics and rarity more than features of the alternative. These 129 species are known from only one or a few sites. Eighty of these species are endemic to the Pacific Northwest, and their extirpation from known locations could potentially cause extinction of the species. In addition, many of these sites represent the type localities from which the original material was collected for describing the species. Cumulative effects on nonfederal land was the primary concern for fourteen of the rare species.

Another reason some species failed to pass the first screen (Assessment Team rating) was the lack of well-distributed old growth at the scale considered necessary for fungi. Past forestry management practices, land ownership patterns and fire history have resulted in a shortage of old-growth forests in certain watersheds, landscape areas and geographic localities. Areas of particular concern are coastal and low elevation forests; especially limited is old growth within the Sitka spruce zone. Of 23 species that showed a strong association with these forests, 16 are rare and/or endemic.

The importance of remnant old-growth stands for many groups of fungi is reflected in the differences in the likelihood of Outcome C and D under Alternative 1 compared to Alternative 9. The retention of old-growth fragments (LS/OG3s) in Alternative 1 resulted in improved outcomes for 97 species. In general, these are the more widely distributed but uncommon species, although the distribution and range of individual species is not well known. The protection of LS/OG3s in watersheds where older stands are deficient would contribute to a well-distributed network of old growth in the near term. Even small stands would improve the outcome for these 97 species. In many cases, these old-growth stands function as refugia where fungi and many other species may persist until suitable habitat conditions become available in adjacent stands. These stands are particularly important for

species with limited dispersal capabilities. While the entire LS/OG3 network would provide maximum protection for these species, substantial benefit may be achieved by addressing retention of LS/OG3s on a watershed level.

Riparian Reserve Scenario 1 was responsible for higher ratings in Alternatives 1 and 4 for two species which failed the FEMAT screen for Alternative 9. These species show a strong preference for habitats associated with seeps and intermittent streams. There are likely many riparian fungus species that will benefit from the Riparian Reserves, although the fungi which inhabit riparian zones were not the focus of the original FEMAT Report analysis.

Management of the matrix was an important consideration in the original Assessment Team ratings in the FEMAT Report, and was another reason why some species did not pass the screen for Alternative 9. Many late-successional and old-growth associated fungi benefit from (if not require) the biological legacies that persist from old-growth stands, including coarse woody debris, habitat structures, and host species. Mycorrhizal fungi require live hosts, including conifers and many species of vascular plants, which in turn depend on the fungi for uptake of nutrients and water. Biological legacies are also important for saprobic and parasitic species of fungi. Many species of fungi require the microclimate that is provided by old-growth stands. Coarse woody debris is an important substrate for many fungi. The short rotation scenario in the matrix (80-120 years) will not provide an adequate renewable supply of large down logs over successive rotations. Forest management may have positive effects such as increasing the sustainability of fungal diversity within managed stands. This could be accomplished by management strategies that would provide for an increase in the diversity of structure and age-class distribution, a diversity of host species, as well as providing for larger logs and snags.

For many of the fungi, specific distribution patterns across the landscape are not well known. Of particular importance is whether or not populations fall within land allocations designated as Late-Successional Reserves or matrix. Providing some carryover of old-growth stands in the matrix would increase the likelihood of maintaining species while additional knowledge is gained on the distribution of individual species and populations, as well as the role of these species in forest succession and ecosystem function.

The limited available knowledge for some species or groups of fungi was a factor in the original ratings. For some fungi, lack of information on specific habitat requirements, geographic distributions and ranges, and locations of populations relative to proposed land allocations in Alternative 9 resulted in conservative ratings. Little is known about how the species composition of fungi changes over time during forest succession, and the relationships among species that occur in young, mature, and old stands.

Cumulative Effects Screen

Sixteen species of fungi were reassessed solely because they failed to pass the cumulative effects screen, although cumulative effects is a concern for many of the species considered in this analysis. Important factors contributing to cumulative effects include land ownership patterns and management practices which result in loss of extensive areas of habitat for late-successional fungi. Particular areas of concern are the coastal and low elevation forests where nonfederal lands play a key role, and where there is a shortage of older age classes on federal land.

Commercial harvest of fungi has greatly increased in recent years, creating potential impacts on species populations and habitats. Harvest of fungi may affect species viability by potentially decreasing distribution, frequency, reproduction and productivity, as well as genetic variability of species. Currently, most of the species that are commercially harvested are not considered at risk, but future impacts may affect their viability.

Deteriorating air quality may result in a decrease in species viability. Evidence from European forests shows a decline of fungal diversity and abundance. Intensive forestry management practices, air pollution and harvest of fungi are factors implicated in this decline. Global climate change could affect distributions of species populations.

Frequency and intensity of treatment, including recreational impacts, is another important factor in cumulative effects analysis. Site treatments that disrupt the soil and litter layer will have a detrimental effect on populations of fungi, and may alter the role of decaying wood in the nutrient-cycling process. Trampling, compacting the soil and litter layer, removing woody debris for firewood or other reasons, or inadvertently introducing non-native species could impact fungal populations, particularly the rare species. Forest management practices and site treatments in early-successional stands could also influence the occurrence and diversity of species in late-successional forests.

Changes to Alternative 9 Screen

The change from the 180-year rotation in northern California was of concern for *Phytoconis ericetorum*, the mushroom lichen, that reaches the southern limit of its distribution in California. Shortened rotations may threaten local populations of this already uncommon species in this area. Persistence of the species in the matrix may depend on management of leave trees and large coarse woody debris. The change from the 180-year rotation was also of concern for five other species.

Primary Mitigation Measures

Survey and Manage Individual Sites

The survey and manage mitigation measure would apply at various levels to all fungus species that were reanalyzed. Levels of survey and general schedules for that survey are displayed in Appendix B11. The most immediate application of the mitigation would be to the 147 fungus species that are considered very rare and/or locally endemic or which have their type localities within the FEMAT area. These species are listed under survey strategy 1 in Appendix B11.

For rare or locally endemic species, or those with type localities in the FEMAT area, this mitigation would call for management of known sites and subsequent inventories for species and management of newly-discovered sites. Management of known sites of rare and locally endemic species could include designation as Special Interest Areas or Areas of Critical Environmental Concern. Management standards and guidelines would be developed that would protect the population from adverse impacts. In particular, all type localities would be managed for the continued viability of the species. These type localities are an important

resource and represent the site where the original material for describing the species was collected. Location and distribution for all the rare or locally endemic taxa would be documented and maintained in a Geographic Information System (GIS) data base.

Of particular concern are the sites where *Oxyporus nobilissimus* occurs. The "Fuzzy Sandoze" is an extremely rare and endemic polypore, and may be petitioned for federal listing under the Endangered Species Act. Live specimens are known only from six localities, ranging from Linn County, Oregon north to the Snoqualmie River valley in the Washington Cascades, and the East Fork of the Humptulips River on the Olympic Peninsula. This species is closely associated with old-growth and late-successional forest structures, and usually occurs with noble fir. In the Olympics it is associated with silver fir. It appears to require very large diameter trees, snags and stumps, but has never been observed on logs. Fruiting bodies are perennial and quite large, therefore this species is relatively easy to survey. Protection of the known populations would decrease the risk of extirpation or extinction. Under this mitigation measure, protection zones of a square mile would be established for known species location that are not otherwise protected. Only two of the localities occur outside of protected areas, so an estimated 1,200 acres is needed for protection of these populations.

Many sites of these rare taxa are known, however literature or herbarium research is needed to identify some localities. As noted in the individual species write-ups, at least 30 rare species have populations within areas that are already protected. These areas may merit designation as Special Interest Areas or Areas of Critical Environmental Concern, and the development of management guidelines to protect the rare species. Under this mitigation, type localities for at least 17 of the rare and/or endemic and/or type locality species not otherwise protected would be temporarily protected from ground-disturbing activities pending site evaluation and population inventory. These species are identified in the individual species write-ups. An area of 160 acres would be temporarily protected pending ground inventory of the habitats and local area. This could amount to an estimated total of 2,500 acres to protect these type localities for rare species. The objective of the ground inventory would be to survey for the species and manage individual sites where they occur. Surveys would aid in identification of habitat requirements and distribution of the population. It is unknown how much habitat for the target species exists on any given site. Final decision on the areas to be managed for protection of the species should be made in consultation with professional mycologists.

For the remainder of the 147 species, the area to be protected would be determined on a site-specific basis. Additional surveys around the known locations would be a high priority for these species.

As more information is acquired, additional sites for rare and endemic taxa may need protection. However, additional information could also reveal that species considered rare are actually more widespread or common. If the need no longer exists, areas being protected for these species may be returned to other allocations.

Fourteen of the rare species face an uncertain future because their continued existence likely depends on management activities and land use of non-federal land. Federal lands in the vicinity of these localities should be surveyed, targeting the habitat of the species, and an attempt should be made to protect locations of the species. Federal agencies should work

with state and private landowners to protect known locations of species of concern and associated habitats.

In addition to protection of sites for individual species, areas which support a diversity of species and concentration of rare and/or endemic fungi could be established as Special Interest Areas or Areas of Critical Environmental Concern to identify the important mycological resource values of the site. Several areas are recommended based on current knowledge: Cascade Head Botanical Area and Experimental Forest, Siuslaw National Forest; Deadfall Meadows, Klamath National Forest; Lamb Butte Scenic Area/Olallie Ridge Research Natural Area, Willamette National Forest; Marys Peak Recreational and Botanical Interest Area, Siuslaw National Forest; Little Sink Area of Critical Environmental Concern/Research Natural Area, Salem District, Bureau of Land Management.

In addition to the 147 rare and endemic species, some level of inventory and site management is recommended for all fungus species that were reanalyzed. The current distribution of all fungus species is poorly known. We do not know where all populations of species occur, the specifics of their habitat requirements, interactions among species, and the successional role of fungus species in different stands or habitats. Of particular importance is the distribution of populations of fungi relative to the land allocations proposed in Alternative 9. This information would be helpful in identifying standards and guidelines for future management that will help increase or maintain fungal species diversity, especially in the matrix.

The resulting strategy for fungi survey is two-tiered, with the first priority to identify the known locations of the rare and endemic fungi, including type localities. Additional survey would be conducted in the areas around these locations. This effort would take about three years, with an estimated cost of \$1 million. The next level of the survey is to establish a regional mycological inventory to develop knowledge, expertise and a database with associated GIS layer for Pacific Northwest fungi, modeled after the Region 6 Ecology Program. The objective of this survey is to develop information on species distributions, habitat/plant associations, successional relationships, and species abundance throughout the region. Species of fungi are also important as indicators of forest and ecosystem health. A regional network of permanent plots will provide valuable baseline data which can be used for monitoring.

This effort should be funded and sustained for at least 10 years in order to accomplish the objectives, with an estimated cost of \$10 million over a ten-year period. Three geographic focal points are recommended to cover the region of Washington, Oregon and California. This would be an efficient way to develop specialized expertise for each state and to minimize travel. A senior mycologist at each center would direct the program, and be assisted by two professionals, seasonal field crews and technicians. Volunteer assistance could be incorporated from local mycological societies and interested amateurs. The field sampling and collecting would occur during the fruiting season, a period of about 5-6 months per year.

There are some difficulties associated with surveying for organisms with ephemeral fruiting bodies. Many fungi do not fruit every year, and species have their particular season of reproductive activity.

It is likely that undiscovered populations of species will occur. Species which are currently thought to be rare or more restricted in their range may actually turn out to be more widespread or abundant. As more information is developed, it will be possible to manage our natural resources more effectively.

A substantial cost is associated with field work, and this survey could be expanded to incorporate other at risk organisms such as lichens and bryophytes. It is probably more cost effective to conduct a complete ecological inventory than focusing on species-specific surveys.

Provide for a Well-Distributed Network of Old-Growth Forests Across the Landscape

Historical events and management practices have resulted in a shortage of old-growth forests in certain localities. Areas of particular concern are coastal and low elevation forests; especially limited is old growth within the Sitka spruce zone. Patches of old growth distributed across the matrix are important refugia for late-successional fungi, as well as a source of inoculum for dispersal into adjacent stands. Proposed mitigation measures that would accomplish this objective are:

Mitigation Measure 17 - Remove inventoried roadless areas from the suitable timber base. Forty-four species of fungi would benefit from this measure, although the specific benefits could not be quantified in the time provided. The species potentially benefited by this mitigation would be those that occur at high elevation. Specific locations of roadless areas relative to the distribution of species populations could be identified to allow this mitigation to be applied in a more site-specific way.

Mitigation Measure 18 - Retain all old-growth forests in Marbled Murrelet Zone 1, including Adaptive Management Areas. This mitigation would benefit 155 species of fungi with coastal or low elevation distributions. In many cases, these old-growth stands function as refugia where fungi and many other species may persist until suitable habitat conditions become available in adjacent stands. These stands are particularly important for species with limited dispersal capabilities. Of specific concern is the availability of old growth in the Sitka spruce zone. Twenty-three species showed strong association for these spruce stands, or other stands along the coast.

Mitigation Measure 19 - Retain old-growth fragments in watersheds where little remains. This measure would benefit 218 species of fungi. This concept is general in nature, and it is likely that all species that occur in these stands will benefit. These isolated remnants are ecologically significant because they function as refugia for a host of old-growth associated species, and are important for those with limited dispersal capabilities.

Mitigation Measure 20 - Provide residual habitat areas around known spotted owl activity centers. This measure would benefit 153 species, primarily those species with lower elevation distributions. Again, this mitigation would help provide for a well-distributed old-growth network, and would benefit all species located in those stands.

Provide for Additional Habitat Elements in Matrix Management

Matrix management is an important consideration in providing for late-successional and old-growth associated fungi. These species would benefit from coarse woody debris, habitat structures, microclimate, and host species retained from the original stand. Specific matrix management provisions which provide for retention of biological legacies from the original stand would reduce risk of extirpation for these fungi.

Mitigation Measure 11 - Provide specified amounts of coarse woody debris in matrix management. This measure would benefit 230 species. Coarse woody debris is an important substrate for many fungi as well as other organisms such as mosses, liverworts, arthropods and amphibians. The objective is to provide this substrate well-distributed across the landscape in a manner which replicates the quantity, quality (such as species and size distribution), and distribution of down logs that would occur in natural, unmanaged stands. Significant quantities of logs are important, as well as a distribution of decay classes. Most species of fungi that were reassessed would benefit from this mitigation, as well as the hundreds of other fungi and organisms that rely on this substrate for habitat. The down logs need to occur in the microclimate provided by the canopy of a forest patch to provide for the fungal species that occupy this substrate. Short rotations (80-120 years) would not provide an adequate renewable supply of large down logs over successive rotations. This possible effect could be mitigated by retaining clumps of green trees in harvest areas and by assuring that the landscape contain suitable proportions of young and old forests.

Mitigation Measure 12 - Emphasize clumped green tree and snag retention in matrix management. This measure would benefit 230 species of fungi reassessed in this analysis. These patches should include not only the biggest and oldest trees, but a diversity of tree sizes, species and ages within a patch. It is important to maintain the microclimate associated with this patch to provide the most benefit to fungi. Retained patches should be protected for multiple rotations so they provide habitat for those organisms which require older forests, in addition to providing habitat connectivity through time.

Mitigation Measure 13 - Modify site treatments, particularly the use of fire and pesticides, and minimize soil and litter disturbance. This measure would benefit 227 species of fungi that were reassessed, although many additional species would benefit from reducing the amount of site disturbance. Yarding and heavy equipment, hot burns for site preparation, removal of humus layers and coarse woody debris, and soil compaction could reduce the viability of certain fungus species. The intensity and frequency of disturbance are important factors to consider in site treatments.

Other Miscellaneous Measures

Mitigation Measure 22 - Manage recreation sites to minimize disturbance. This measure would benefit 45 species of fungi which are known to occur in recreational areas. Most of these are rare and locally endemic fungi, and this measure would help reduce the risk of extirpation of these species.

Mitigation Measure 23 - Other mitigation measures which could be applied in specific instances for the benefit of certain species include protecting type localities from fire;

monitoring commercial harvest and possibly developing regulations to provide for sustainable production of species populations; and lengthening rotations in specific areas of California to address species concerns. Fourteen species are identified in this category, and may also be addressed in conjunction with Mitigation measure 1 which provides for surveys to acquire additional information and ascertain levels of protection.

Riparian Reserves

Mitigation Measure 5 - Apply Riparian Reserve Scenario 1 to all intermittent streams throughout the range of the northern spotted owl. This measure would directly benefit 7 species of fungi that occupy riparian habitats, and another 16 species that occupy moist habitats. This measure would also benefit many more species not identified here.

Limitations of Mitigation Measures

Even if all mitigations were implemented, there would still be some risk of extirpation, particularly for the rare and endemic species. This would be particularly true for 14 species for which cumulative effects would remain a concern. These include species of rare false truffles, rare truffles, undescribed taxa of rare truffles and rare false truffles, rare zygomycetes, rare cup fungi, and parasitic fungi.

C. Lichens

Introduction

All 16 groups of lichens, representing 136 species, failed to pass the first screen based on the original Assessment Team ratings in the FEMAT Report. However, 5 groups (57 species; 42 percent) failed due to a low number of likelihood points in Outcome D (restriction to refugia). This rating may have reflected general uncertainty regarding the future of these species. Groups that received less than 3 likelihood points in Outcome D were not evaluated further if the total points in C and D were less than 20.

In order to better reflect specific information that was available, species were analyzed separately, rather than in the groups addressed in the FEMAT Report (Table IV-18). Seventy-five species of lichens failed to pass the (modified) FEMAT screen and received additional analysis. In general, the primary factors that affected the Assessment Team ratings in the FEMAT Report were acreage of Late-Successional Reserves, stand treatment within the Matrix, and protection of riparian corridors (FEMAT, IV-95). Aquatic and riparian lichens rated higher in alternatives with greater riparian protection.

No additional species were evaluated based only on cumulative effects concerns. However, the potential for cumulative effects was reviewed for all species. For lichens, the primary cumulative effects concerns are related to deteriorating air quality because lichens are very sensitive to air pollution, collection of lichens as special forest products (and incidentally during moss harvest), and activities on nonfederal lands.

Primary Mitigation Measures

The primary mitigation measures identified as benefiting lichens were prescriptions for green-tree retention in the matrix, inventory and management of sites, and provision of a well-distributed network of late-successional and old-growth stands throughout the landscape. Riparian Reserve Scenario 1 on intermittent streams would benefit the riparian and aquatic species, although this measure may not be required to raise the ratings if site-specific mitigations are implemented where species are considered at risk. Implementing the proposed mitigation measures would increase the ratings for nitrogen-fixing lichens, riparian and aquatic lichens, and may increase the ratings for all other groups. The extremely slow growth rates and long periods required for certain late-successional and old-growth associated lichens to colonize stands emphasizes the considerable importance to these species of existing old stands and old trees within younger stands.

Survey and Manage Individual Sites

Survey and management of individual sites is recommended to maintain habitat for the rare and/or locally endemic species. This mitigation would be particularly beneficial to the 16 species of oceanic lichens because they are known to be fairly narrowly restricted along the coast within sight of the ocean. Specific sites would be evaluated and prioritized for management to protect these species. Designation of Special Interest Areas or Areas of Critical Environmental Concern could be appropriate measures for sites where lichens are found. Three aquatic lichens require clear water; therefore, evaluation of upstream management and sediment loads may be necessary. Known locations of rare rock lichens would be managed to maintain their habitat under this mitigation.

Surveying for many of the other more widely-distributed species is somewhat problematic. In general, the nitrogen-fixing lichens will be difficult to survey due to the position they occupy in the forest canopy. Many of these species do not enter stands until the stand reaches 150-200 years. These species often occupy the large, lateral branches within the canopy. These are fairly stable substrates, and it is uncommon for these large branches to break off and fall to the forest floor. For many of these species, the only way to verify their presence is to sample the canopy, which is logistically difficult and expensive. While it is not feasible to apply the survey and manage measure widely for these species, it may be necessary to survey specific sites or potential habitats of rare species. Site-specific treatments need to be developed that would protect the integrity of the habitat and provide for these rare species, since they are at a much higher risk of extirpation.

The cost of surveys recommended as mitigation measures for lichens that did not pass the screens is estimated at \$500,000. Initially, surveys would focus on the vicinity of known locations of populations of rare or endemic species. These populations are important to manage in order to prevent their extirpation. Other surveys would be accomplished as part of watershed analysis to determine species diversity and abundance of species within geographic areas, successional stages and habitats. It would be efficient to incorporate lichen surveys into a regionwide ecological inventory such as is proposed for the fungi. It is more cost effective to sample for various species at the same time. The benefit of this level of survey is the generation of more information on the distribution, abundance and habitat preferences of lichen species.

Matrix Management Provisions

Emphasis on clumped green tree and snag retention in the matrix could benefit 58 species of lichens which were analyzed. Clumping the leave trees would moderate climatic factors and provide a variety of microclimates that contribute to the survival of many lichen species, as well as provide additional habitat for dispersal. Lichens may be limited in their dispersal capabilities, and are slow to recolonize stands; therefore, patches of leave trees function as refugia where these old-growth associated species can persist until conditions become suitable for their establishment in the developing stand.

The selection of specific trees to retain is an important component of this mitigation measure. To the extent possible, the biggest, oldest trees with the most diverse structural characteristics would be retained. This would provide for a diversity of microhabitats and associated species diversity. Trees that have an abundant epiphytic flora should be favored when selecting the leave trees, because they provide a source of genetic material and propagules for a greater number of species. Selecting for heterogeneity may enhance biological diversity across the landscape for this group of organisms. Leaning trees are important for the pin lichens because of the difference in stem flow or exposure on various parts of the tree. These retained patches would be protected for multiple rotations to provide habitat for these organisms which require older forests, and to provide for habitat connectivity through time. This becomes particularly important for the nitrogen-fixing lichens due to their slow colonization and growth rate.

Modifying site treatment practices, particularly limiting broadcast and slash burning and the use of herbicides, would benefit most species of lichens, and was specifically addressed for the 20 nitrogen-fixing species.

Provide for a Well-Distributed Network of Old-Growth Forests Across the Landscape

Older stands that are well-distributed geographically would improve the likelihood of survival and persistence of lichens in the ecosystem. Many old-growth forest lichen species require the ecological continuity of old stands in order to persist. These stands are important refugia, particularly for lichens that have limited dispersal capabilities. Historic events and management practices have resulted in a shortage of late-successional and old-growth stands in certain areas. Areas where late-successional and old-growth stands are particularly scarce are the coastal and low elevation forests. It would benefit lichens to retain what remains of these older stands in geographic areas or watersheds where it is limited, and to identify replacement stands which would be allowed to develop into old-growth where there is, or is anticipated to be, a shortage of this age class in the landscape. Low elevation stands may be particularly important for the nitrogen-fixing species, which generally occur at elevations below 3,000 feet.

The mitigation measures that would provide for a well-distributed network of late-successional and old-growth stands across the landscape include: retaining all old-growth forests within Marbled Murrelet Zone 1, providing for retention of old-growth fragments in watersheds where little remains, providing for residual habitat areas around known spotted

owl activity centers, and removing the inventoried roadless areas and Tier 1 Key Watersheds from the suitable timber base. These mitigation measures would benefit 61 lichen species that were addressed in this analysis.

Riparian Reserves

Riparian Reserve Scenario 1 would benefit three species of aquatic lichens, and nine species of riparian lichens. These species could also be mitigated by site-specific measures directed at species populations and maintaining the integrity of habitat where known populations occur.

Other Miscellaneous Measures

Managing recreation areas to minimize disturbance to species was identified as an important mitigation for the oceanic lichen species. Applying this mitigation measure would benefit 16 species of lichens, 3 of which are endemic. These species occur in close proximity to the ocean, and recreation and development could potentially impact their populations.

An air quality monitoring program could be initiated across the region using lichens as biological indicators of air quality. Nitrogen-fixing lichens are negatively affected by air pollution and are especially sensitive to sulfur dioxide. This monitoring is important in order to establish baseline conditions, to document future trends, and to monitor changes in forest health.

Limitations of Mitigation Measures

Even if all mitigation measures were implemented, there would still be risk of extirpation, particularly for the rare and endemic species. However, this risk would be substantially reduced by implementation of the mitigation measures. Some risk may remain due to cumulative effects. For example, deteriorating air quality may result in local or widespread extirpation of lichen species. This has already been documented in many parts of Europe and eastern North America.

D. Vascular Plants

Seventeen vascular plant species were reanalyzed in all or portions of their ranges. All species that failed the screens were either rare within the range considered or locally endemic. Five species were narrowly endemic with known distributions spanning one to four National Forests (*Aster vialis*, *Clintonia andrewsiana*, *Corydalis aquae-gelidae*, *Pedicularis howellii*, and *Scoliopus bigelovii*); of these, two are federal candidate species (*Aster vialis*, *Corydalis aquae-gelidae*). All others are considered rare either throughout their entire range or within the planning area. Six species (*Arceuthobium tsugense*, *Botrychium minganense*, *Coptis trifolia*, *Cypripedium montanum*, *Galium kamtschaticum*, and *Habenaria orbiculata*) have ranges that extend beyond the planning area and may be more common in other portions of their range.

Three species failed due primarily to concerns regarding cumulative effects (*Bensoniella oregona*, *Clintonia andrewsiana*, and *Scoliopus bigelovii*).

For all species that failed the screens, inventories and subsequent protection of known sites and management of their habitat to maintain population viability would significantly increase ratings. All but five of these species (*Abies lasiocarpa* (in California), *Bensoniella oregona*, *Coptis asplenifolia*, *Cypripedium fasciculatum*, and *C. montanum*) would then pass the screens. For *Abies lasiocarpa*, no additional mitigation could raise the ratings due to the species rarity in the portion of the range considered; however, this species is widespread and common elsewhere. Cumulative effects were of greatest concern for *Bensoniella oregona*; only one population in California is known to occur on federal land. This species would benefit from protection of additional late-successional old-growth habitat in the California Coast Range Province. Regardless of protection, however, it would remain likely to be extirpated or restricted to refugia. Cumulative effects were also a concern for *Coptis asplenifolia*, which is reported from two disjunct populations in the north Coast Range of Oregon on nonfederal land and six sites in Washington state in the Olympic Peninsula and Washington Cascades. In this portion of its range, it is strongly associated with old growth and found only in very old stands. It would receive greatest protection from inventories, protection of sites, and from retaining all old-growth fragments in the Marbled Murrelet Zone.

For some species, management of sites may require active intervention rather than simple protection. Site-specific management may include the introduction of fire, within the proposed fire standards and guidelines. It will be important to conduct experimental studies to develop effective prescriptions that minimize risk and maximize benefit on a local basis. Fire suppression is considered to have contributed to the decline of at least three species considered (e.g., *Cypripedium fasciculatum*, *C. montanum*, *Aster vialis*). Perhaps due to higher fire frequency east of the Cascades Range, *Cypripedium montanum* is more abundant in the Cascade province. Selection of Alternative 1 would be necessary to raise ratings to the point where these species would pass the screen for the Klamath province portion of the range of *Cypripedium fasciculatum* and the Cascade province portion of the range of *C. montanum*. The protection of all late-successional and old-growth fragments was the key feature of Alternative 1 responsible for the significantly higher ratings. However, even under Alternative 1, there is a high risk of extirpation for *C. fasciculatum* in the Cascades and *C. montanum* west of the Cascades. Only through protection of known sites and specific management, including reintroduction of prescribed fire, would the risk of extirpation be reduced for these species.

For most of the species rated, considerable information exists regarding their range, distribution, and habitat. For some, detailed conservation strategies exist, but not all strategies have been adopted and implemented. Protection of known populations and their habitat would bring five species to the point where they would pass the screens, although additional surveys are recommended.

Riparian Reserves also provide significant protection to four species (*Bensoniella oregona*, *Botrychium montanum*, *B. minganense*, *Corydalis aquae-gelidae*, *Galium kamchaticum*); and may provide at least marginal benefit to others. There was some concern among the Species Analysis Team members that riparian protection may increase pressure to log upland sites, placing rare drier-site species (*Allotropa virgata*, *Pedicularis howellii*) at greater risk.

It is unknown whether the species analyzed here could persist in small patches of leave trees clumped within the matrix; however the legacies provided by this mitigation measure would provide future habitat. Although some species may have specific microclimate requirements

and may not persist, at least marginal benefit would be provided by clumped rather than scattered leave trees. Coarse woody debris in the matrix was considered important to at least two species and would significantly increase the ratings.

Small late-successional and old-growth fragments were very important to many vascular plant species. Because six species occur within or are restricted to the coast ranges, these species would benefit from retaining all old-growth fragments within the Marbled Murrelet Zone 1. Very old stands (greater than 600 years) were particularly important to one species. Although roadless areas are among the least well-known botanically, retaining old-growth fragments in watersheds where little remains could benefit at least five of the species considered here.

The consequences of not implementing the possible mitigation measures may include the loss of biological diversity, but is probably unlikely to result in losses of ecosystem function. In some cases, populations of species considered as sensitive by the BLM and Forest Service may be protected under existing land management planning regulations.

It is unlikely that failure to implement the possible mitigation measures will result in the listing of the two federal candidate vascular plant species considered here. However, the additional mitigation proposed would benefit other federally listed and candidate vascular plant species discussed in the Draft Biological Opinion. These species were not considered closely associated with late-successional and old-growth forests, but could be affected by the alternative selected. Other mitigations may be necessary (e.g., protection of special habitats) to maintain viable populations of these species.

Assumptions - Estimates of cost for surveys were calculated using the following criteria.

- All species must be considered and surveyed for during watershed analysis.
- Species that are wide ranging would best be surveyed for in watershed analysis.
- The species for which ranges are limited and distributions are fairly well documented would require the least funding.
- Agency botanists will be available to conduct surveys. Contracting costs would be significantly higher. Benefits of utilizing agency botanists include greater familiarity with local area and species, and the value of bringing increased knowledge to watershed analysis and Interdisciplinary Team processes.
- In some cases, surveys may be combined with those for other species; (e.g., *Arceuthobium* census while doing marbled murrelet surveys, *Corydalis* inventories while doing stream surveys).
- Most species inventories could be facilitated by development of prediction models which allow identification of high probability habitat.
- Surveys for certain species should be conducted over a several year period, due to differences in annual emergence (e.g., *Allotropa*, orchids).

Logistics and Feasibility - Surveys for rare plants are routinely done in project areas in compliance with National Environmental Policy Act (NEPA) regulations and field protocols are well established. For some species, surveys have been limited primarily to project areas; for others, intensive inventories have been undertaken throughout their expected range. Because many rare plants have narrow habitat requirements, development of prediction

models will be an effective method of focusing on high probability habitat and reducing inventory costs. Once prediction models are developed, vegetation layers in GIS can facilitate location of potentially suitable habitat. Estimated costs for surveys to implement the survey and manage mitigation measure are shown in Table J2-4.

Table J2-4. Estimated costs of inventory mitigation for vascular plants

Species	Cost or Survey Strategy
<i>Abies lasiocarpa</i> in California	surveys not proposed as mitigation
<i>Alloctropa virgata</i>	Watershed Analysis
<i>Arceuthobium tsugense</i>	Watershed Analysis
<i>Aster vialis</i>	\$20,000
<i>Bensoniella oregana</i>	\$20,000
<i>Botrychium minganense</i>	Watershed Analysis
<i>Botrychium montanum</i>	\$30,000
<i>Clintonia andrewsiana</i>	\$30,000
<i>Coptis asplenifolia</i>	Watershed Analysis
<i>Coptis trifolia</i>	Watershed Analysis
<i>Corydalis aquae-gelidae</i>	\$20,000
<i>Cypripedium fasciculatum</i>	\$60,000
<i>Cypripedium montanum</i>	\$60,000
<i>Galium kamtschaticum</i>	\$20,000
<i>Habenaria orbiculata</i>	\$30,000
<i>Pedicularis howellii</i>	\$20,000
<i>Scolopos bigelovii</i>	\$20,000

Prior to field inventory, the first step is to create up-to-date rangewide distribution maps for each species using Forest Service and BLM data (including Ecology Plot Data and Botanical Inventories), State National Heritage Program Data, existing range maps in monographs, and herbarium data. The Interagency Resource Information Group within the Regional Ecosystem Office should assist with mapping and data base management.

Surveys must be conducted when the species is identifiable. Many species can be identified by their vegetative characteristics and may therefore be recognized over a longer period than species for which flowers or fruits are needed for identification. Some species are conspicuous and recognizable from a distance (e.g., *Alloctropa virgata*); others require a much tighter survey grid and a more intensive search (e.g., *Botrychiums* and *Cypripediums*).

For wide-ranging species, it will be more effective to collect location data during watershed analysis field surveys and project-level surveys rather than in rangewide surveys. It will be essential for field surveys to be conducted during watershed analysis at an appropriate level of intensity, with the aid of prediction models and prefield identification of suitable habitat using aerial photography and existing locality maps and data.

Estimated Number of Acres in Protected Status

A very coarse estimate of number of acres that would require protection through the survey and manage provision is provided below (Table J2-5). These are acres outside of the Reserves (e.g. Late-Successional Reserves, Congressionally Reserve Areas, Riparian Reserves, and existing Administratively withdrawn Areas, including Areas of Critical Environmental Concern and Botanical Special Interest Areas) designated in Alternative 9.

Table J2-5. Estimated of number of acres that would require protection through the survey and manage provision

Species	Acres
<i>Abies lasiocarpa</i> in California	none
<i>Allotropa virgata</i>	500
<i>Arceuthobium tsugense</i>	500
<i>Aster vialis</i>	1,000
<i>Bensoniella oregana</i>	2,500
<i>Botrychium minganense</i>	300
<i>Botrychium montanum</i>	2,000
<i>Clintonia andrewsiana</i>	1,200
<i>Coptis asplenifolia</i>	500
<i>Coptis trifolia</i>	500
<i>Corydalis aquae-gelidae</i>	2,000
<i>Cypripedium fasciculatum</i>	5,000
<i>Cypripedium montanum</i>	5,000
<i>Galium kamtschaticum</i>	50
<i>Habenaria orbiculata</i>	500
<i>Pedicularis howellii</i>	2,000
<i>Scoliopus bigelovii</i>	1,000
Total	24,550

Some potential for overlap in acres exists because some species may occur coincidentally, (e.g., *Scoliopus bigelovii* and *Clintonia andrewsiana*; *Arceuthobium tsugense* and *Coptis asplenifolia*).

Estimated Costs of Management

In addition to protection of specific sites, management prescriptions may be required for continued or increased viability of populations. For example, many species may decline as a result of fire suppression. However, little is known about specific responses to management treatments. Experimental manipulations with controls would be needed before a treatment is widely prescribed.

The cost associated with identifying specific management prescriptions will vary with the species. Some studies are well established (e.g., work coordinated by R. Harrod on

Cypripedium fasciculatum, and *N. Wogen* on *Aster vialis*). All have been limited by funding; all would benefit by greater interagency coordination and strong management direction to identify these efforts as priorities.

Interagency identification of priorities is key to making the best, most efficient use of limited funding. Based on the results of this analysis, three common themes have emerged: (1) the role of fire, (2) the role of coarse woody debris and interrelationships between fungal symbionts, pollinators, and dispersers, and (3) the effectiveness of small fragments of old-growth forest in maintaining viable populations of species at risk of extirpation or restriction to refugia.

Partnerships have been forged among universities, experiment stations, and state and private agencies that share conservation goals and interest in learning more about specific requirements for rare and threatened vascular plants. Many opportunities exist for partnerships, such as the Forest Service's Challenge Cost Share program, that would increase cost-effectiveness of studies to define habitat and species management requirements.

For some species, existing conservation strategies provide direction for management on individual forests. Funds should be earmarked for the preparation of Interagency Conservation Strategies that would include up-to-date information, management recommendations, and monitoring plans. Cost of preparation of strategies will vary; past costs have ranged from \$7,000 to \$20,000.

E. Arthropods

Overview

Arthropods are unique compared to other groups of organisms considered in this analysis. There are more species than all other organisms combined. This great number of species of arthropods and individuals, when combined with their habitat and substrate specificity, make them fine-grained reflectors of environmental conditions. While the species treatments of other groups of plants and animals in this analysis were nearly exhaustive, only a very small fraction of arthropods could have been considered in the time available because of the large number of species, the scattered nature of the available information and the lack of research. Therefore, the Assessment Team classified the arthropods into 15 functional groups. These groups were used for rating the species in both the FEMAT report and in Chapter 3&4 of this EIS. Examples of species that are included in each of the functional groups are provided in Table J2-6. It was provided by Dr. John D. Lattin, Department of Entomology, Oregon State University as an attachment to his comments on the Draft SEIS. The list has been annotated to indicate the "functional group" for each species. It provides more specific examples of the arthropod taxa closely-associated with late-successional forests and the functional group in which they were counted. It also includes some functional groups which were not specifically addressed in the FEMAT ratings, but whose habitat needs are expected to have been addressed by the functional groups which were rated. The functional groups which were not specifically addressed by FEMAT are noted with an (*).

Table J2-6. Arthropod species closely associated with late-successional forests, and functional groups with which they are identified

Arthropoda

Class Insecta

Thysanura

Lepidotrichidae

Tricholepidion gertschi Wygodzinsky (Coarse wood chewer, South)

Ephemeroptera

Ephemerellidae

Drunella doddsi (Needham)

Ephemerella infrequens McDunnough (Aquatic herbivore)

Plecoptera

Capniidae

Paracapnia oswegaptera Jewett (Aquatic detritivore)

Leuctridae

Paraleuctra andersoni Harper and Wildman (Aquatic detritivore)

Orthoptera

Acrididae

Boonacris alticola Rehn and Randall (Understory herbivore)

Boonacris polita (Scudder) (Understory herbivore)

Gryllacrididae

Pristoceuthophilus celatus (Scudder) (Litter & soil dwelling)

Pristoceuthophilus cercialis Caudell (Litter & soil dwelling)

Pristoceuthophilus sargentae Gurney (Litter & soil dwelling)

Tropidischia xanthostoma (Scudder) (Litter & soil dwelling)

Blattaria

Cryptocercidae

Cryptocercus punctulatus Scudder (Coarse wood chewer, North & South)

Isoptera

Hodotermitidae

Zootermopsis angusticollis (Hagen) (Coarse wood chewer, North & South)

Hemiptera: Heteroptera

Anthocoridae

Tetraphleps latipennis Van Duzee (Canopy predator) *

Tetraphleps pilosipes Kelton and Anderson (Canopy predator) *

Xylocoris umbrinus Van Duzee (Coarse wood - under barkpredator) *

(Table J2-6. continued)

Aradidae

Mezira pacifica Usinger (Coarse wood, fungus feeder, under bark)

Coreidae

Leptoglossus occidentalis Heidemann (Canopy herbivore, North & South)

Enicocephalidae

Boreostolus americanus Wydogzinsky and Stys (Riparian predator)

Hymenocoris formicina Uhler (Litter & soil dweller, South)

Systelloderes grandes Kritsky (Riparian predator)

Lygaeidae

Gastrodes pacificus (Provancher) (Canopy herbivore of seeds, North & South)

Malezonotus obrieni Ashlock (Litter seed feeder, North & South)

Plinthisus longisetosus Barber (Litter seed feeder, North & South)

Thylochromus nitidulus Barber (Litter seed feeder, North & South)

Miridae

Allorhinocoris speciosus Bliven (Understory herbivore, North & South)

Atractotomus cooperi Stonedahl (Canopy herbivore/predator)*

Atractotomus kolenati (Flor) (Canopy herbivore/predator)*

Deraeocoris piceicola Knight (Canopy predator)*

Eurychilopteryella sp. nov. (Canopy predator)*

Largidea pudica Van Duzee (Canopy predator)*

Neoborella xanthenes Herring (Canopy herbivore of mistletoe)

Phytocoris nobilis Stonedahl (Canopy predator)*

Pinalitus solivagus (Van Duzee) (Canopy herbivore)

Pithanus maerkelii (H.-S.) (Understory & forest gap herbivore)

Platylygus pseudotsugae Kelton (Canopy herbivore)

Polymerus castilleja Schwartz (Understory & forest gap herbivore)

Nabidae

Pagasa fusca (Stein) (Litter & soil predator)

Pentatomidae

Zicrona caerulea (L.) (Canopy predator) *

Scutelleridae

Vanduzeeina borealis californica Van Duzee (Litter seed & grass feeder)

Tingidae

Acalypta mera Drake (Litter herbivore of moss)

Acalypta saundersi (Downes) (Litter herbivore of moss)

Acalypta vanduzeei Drake (Litter herbivore of moss, South)

Acalypta vandykei Drake (Litter herbivore of moss, South)

(Table J2-6. continued)

Derephysia foliacea (Fallen) (Understory & forest gap herbivore)
Physatocheila variegata Parshley (Canopy herbivore)

Hemiptera: Homoptera

Aphididae

Aulacorthum dorsatum Richards (Understory herbivore)
Boernerina variabilis Richards (Canopy herbivore)
Drepanosiphum oregonensis Granovsky (Canopy herbivore)
Essigella wilsoni Hottes (Canopy herbivore)
Illinoia patriciae (Robinson) (Canopy herbivore)
Illinoia rhododendri (Wilson) (Understory herbivore)
Macrosiphum (Sitobion) osmaoniae (Wilson) (Understory herbivore)
Macrosiphum (Sitobion) tolmiea (Essig) (Understory herbivore)
Mindarus abietinus Koch (Canopy herbivore)
Uroleucon adenocaulonae (Essig) (Understory herbivore)

Megaloptera

Corydalidae

Orohermes crepusculus (Chandler) (Aquatic predator)

Coleoptera

Amphizoidae

Amphizoa insolens LeConte (Aquatic detritivore)

Buprestidae

Buprestis aurulenta L. (Coarse wood chewer)
Melanophila drummondi Kirby (Coarse wood chewer)

Byrrhidae

Listemus formosus Casey (Litter & soil detritivore)

Cantharidae

Podabrus piceatus Fender (Understory predator)

Carabidae

Agonum ovipenne Mannerheim (Litter predator)
Bembidion spectabile Mannerheim (Litter & moss predator)
Cychrus tuberculatus Harris (Litter predator on snails)
Harpalus cordifer Notman (Litter predator)
Notiophilus sylvaticus Escholtz (Litter predator on collembola)
Promecognathus crassus LeConte (Litter predator on millipedes)
Pterostichus (Anilloferonia) rothi Hatch (Litter & soil predator)
Pterostichus (Hypherpes) crenicollis LeConte (Riparian predator)
Scaphinotus (Neocychrus) longiceps Van Dyke (Litter & soil predator, South)
Scaphinotus (Stenocantharis) johnsoni Van Dyke (Litter & soil predator on snails)
Stomis termitiformis Van Dyke (Litter & soil predator, North & South)

(Table J2-6. continued)

Tachyta falli Hayward (Coarse wood/under bark, predator)
Tachypachus holmbergi Motschulsky (Riparian predator)
Trechus humboldti Van Dyke (Litter & soil predator)
Zacotus matthewsi LaConte (Litter & soil predator)

Cerambycidae

Dicentrus bluthneri LeConte (Canopy herbivore)
Leptalia macilenta (Mannerheim) (Canopy herbivore)
Ulochaetes leoninus LeConte (Canopy herbivore)
Xestoleptura crassipes (LeConte) (Canopy herbivore)

Chrysomelidae

Chrysomela interna Brown (Riparian canopy herbivore)
Pyrrhalta carbo LeConte (Canopy riparian herbivore)
Timarcha intricata Haldeman (Understory herbivore)

Cincindelidae

Omus dejeani Reiche (Litter & soil predator)

Ciidae

Cis maritimus (Hatch) (Coarse wood chewer)

Coccinellidae

Anatis rathvoni (LeConte) (Canopy predator) *
Mulsantia picta (Randall) (Canopy predator) *

Cucujidae

Dendrophagus glaber LeConte (Underbark predator) *

Curculionidae

Lobosoma horridum Mannerheim (Litter & soil herbivore/detritivore)
Pissodes utahensis Hopkins (Litter & soil herbivore/detritivore)

Lampyridae

Ellychnia hatchi Fender (Litter & soil predator)

Leiodidae

Catopocerus capizzii Hatch (Litter & soil detritivore)

Lucanidae

Platycerus oregonensis Westwood (Coarse wood chewer)

Lycidae

Dictyopterus simplicipes Mannerheim (Litter predator)

Platypodidae

Platypus wilsoni Swaine (Coarse wood chewer)

(Table J2-6. continued)

Pselaphidae

- Actium microphthalmum* Park and Wagner (Litter & soil)
- Euborhexius sinus* Gigarick and Schuster (Litter & soil)
- Oropus microphthalmus* Chandler (Litter & soil)
- Sonoma cascadia* Chandler (Litter & soil)

Scarabaeidae

- Pleocoma dubitalis* Davis (Soil herbivore of roots)

Scolytidae

- Dendroctonus pseudotsugae* Hopkins (Epizootic forest species)
- Phloeosinus sequoiae* Hopkins (Epizootic forest species)
- Scolytus oregoni* Blackman (Epizootic forest species)

Staphylinidae

- Omalorphanus aenigma* Campbell and Chandler (Litter & soil)
- Tachinus semirufus* Horn (Litter & soil)

Zopheridae

- Phellopsis porcata* LeConte (Coarse wood chewer/fungus)

Mecoptera

Boreidae

- Caurinus dectes* Russell (Understory herbivore of liverworts)
- Hesperoboreus brevicaudus* (Byers) (Litter & soil herbivore of moss)

Panorpididae

- Brachypanorpa oregonensis* (MacLachan) (Understory predator) *

Trichoptera

Rhyacophildae

- Himalopsyche phryganea* (Ross) (Aquatic predator)
- Rhyacophila willametta* Ross (Aquatic predator)
- Rhyacophila haddocki* Denning (Aquatic predator)

Philopotamidae

- Dolophilodes novusamericana* (Ling) (Aquatic detritivore)

Psychomyiidae

- Tinodes cascadia* Denning (Aquatic herbivore)

Hydropsychidae

- Homoplectra alsea* Ross (Aquatic detritivore)

Phryganeidae

- Yphria californica* (Banks) (Aquatic predator)

(Table J2-6. continued)

Limnephilidae

- Apatania sorex* (Ross) (Aquatic herbivore)
- Oligophlebodes sierra* Ross (Aquatic detritivore)
- Neothremma andersoni* Wiggins (Aquatic herbivore)
- Farula jewetti* Denning (Aquatic herbivore)
- Halesochila taylori* (Banks) (Aquatic detritivore)
- Philocasca demita* Ross (Aquatic detritivore)
- Goera archaon* Ross (Aquatic herbivore)

Lepidostomatidae

- Lepidostoma cascadenae* (Milne) (Aquatic herbivore)

Brachycentridae

- Eobrachycentrus gelidae* Wiggins (Aquatic herbivore)

Lepidoptera

Cosmopterigidae

- Walshia miscecolorella* (Chambers) (Understory herbivore)

Drepanidae

- Drepana arcuata* Walker (Riparian canopy herbivore)

Geometridae

- Carripeta aequalaria* Grote (Canopy herbivore)
- Drepanulatrix carnearia* (Hulst) (Understory herbivore)
- Nepytia phantasmaria* (Strecker) (Canopy herbivore)

Micropterygidae

- Epimartyria pardella* (Walsingham) (Litter & soil herbivore of moss)

Noctuidae

- Achytonix epipaschia* (Grote) (Canopy herbivore)
- Bomolocha bijugalis* (Walker) (Understory herbivore)
- Feralia deceptiva* McDunnough (Canopy herbivore)
- Oncocnemis dunbari* (Harvey) (Understory herbivore)
- Zotheca tranquillâ* Grote (Understory herbivore)

Pyralidae

- Myelopsis coniella* (Ragonot) (Riparian canopy herbivore)

Tortricidae

- Zeiraphera hesperiana* Mutuurg and Freeman (Canopy herbivore)

Diptera

Tipulidae

- Chionea* sp. (Litter & soil herbivore)

(Table J2-6. continued)

Drosophilidae

Drosophila montana Stone, Griffen and Patterson (Coarse wood, fungus feeder)

Deuterophlebiidae

Deuterophlebia inyoensis Kennedy (Aquatic herbivore)

Psychodidae

Maurina sp. (Aquatic herbivore)

Simuliidae

Parasimulium sp. nov. (Aquatic herbivore)

Syrphidae (Pollinators)

Hymenoptera

Andrenidae (Pollinators)

Apidae (Pollinators)

Anthophoridae (Pollinators)

Cimbicidae

Zaraea americana Cresson (Understory herbivore)

Formicidae

Amblyopone oregonense (Wheeler) (Litter & soil predator)

Camponotus modoc Wheeler (Coarse wood chewer)

Ichneumonidae

Aplomerus robustus Townes (Coarse wood chewer parasitoid)

Rhyssa alaskensis Ashmead (Coarse wood chewer parasitoid)

Megachilidae (Pollinators)

Orussidae

Orussus thoracicus (Ashmead) (Coarse wood chewer parasitoid)

Siricidae

Xeris morrisoni (Cresson) (Coarse wood chewer)

Tenthredinidae

Empria multicolor (Norton) (Riparian canopy herbivore)

Monophadnoides geniculatus (Hartig) (Canopy herbivore)

Phymotocera similata (MacGillivray) (Canopy herbivore)

(Table J2-6. continued)

- Class Diplopoda
 - Xestodesmidae
 - Harpaphe haydeniana haydeniana* (Wood) (Litter & soil)
- Class Crustacea
 - Isopoda
 - Ligidium gracile* Dana (Litter & soil)
- Class Arachnida
 - Subclass Opiliones
 - Subclass Araneae
 - Agelenidae
 - Blabomma oregonensis* (Chamberlin and Ivie) (Litter predator)
 - Cybaeus reticulatus* Simon (Litter predator)
 - Amaurobiidae
 - Callobius severus* (Simon) (Litter predator)
 - Antrodiaetidae
 - Antrodiaetus occultus* Coyle (Litter & soil predator)
 - Antrodiaetus pugnax* (Chamberlin) (Litter & soil predator)
 - Linyphiidae
 - Lepthyphantes zibus* Zorsch (Litter predator)
 - Linyphantes pualla* Chamberlin and Ivie (Litter predator)
 - Scironis sima* Chamberlin (Litter predator)
 - Tachygyna vancouverana* Chamberlin and Ivie (Litter predator)
 - Salticidae
 - Neon reticulatus* Blackwell (Litter predator)
 - Theridiidae
 - Theridion sexpunctatum* Emerton (Canopy predator) *
 - Subclass Acari
 - Dithinozeroconidae
 - Caminella paraphora* Krantz and Ainscough (Aquatic/moss nematode predator)

The original description of the outcomes that were used for rating species were developed for individual species. Rating species in groups required a modification of the definition. Outcomes A through D were applied to these functional groups as follows:

Outcome A - Key ecological functions of the group would be maintained in a well-distributed pattern across federal lands.

Outcome B - Key ecological functions of the group would be maintained on much of the federal landscape, but there would be gaps where these functions would be impaired.

Outcome C - Key ecological functions of the group would not be maintained over much of the federal landscape, with function continuing unimpaired in restricted "islands" or refugia.

Outcome D - Key ecological functions of the group would not be maintained on federal lands.

For several functional groups, north and south portions of ranges were evaluated separately. This reflected the significant differences in plant communities, geological and disturbance history, and environmental conditions between northern and southern areas of the range of the northern spotted owl. Southern ranges included the California Coast Range Province, the Oregon and California Klamath Provinces, and the California Cascades Province, with the remainder of the provinces included within the northern ranges.

Four groups failed to pass the first screen (the original rating in the FEMAT Report). Groups failing the screen were: canopy herbivores, coarse woody debris chewers, litter and soil dwelling species, and understory and forest gap herbivores. All of these groups were from the southern portion of the range of the northern spotted owl. No additional groups were added as a result of changes to Alternative 9 between Draft and Final SEIS, cumulative effects, or species-specific criteria.

Southern portions of the range had higher likelihoods for Outcome D because of the large number of endemic species with very limited ranges, potential for drought, significant risk of fire, patchy distribution of suitable habitats, and past management activities. Furthermore, adequate studies of taxonomy, species distribution and habitat dynamics are lacking.

Summaries for Functional Groups

Canopy Herbivores (south)

The Assessment Team ratings for this group reflected uncertainty and concern about the lack of knowledge of the distribution and habitat dynamics of this group, as well as future global change. Many of the species in the group are endemic to northern California or southern Oregon and could be lost if their specific habitats were destroyed. However, the Assessment Team judged that for Alternative 9, the likelihoods of Outcome C and D totalled 6 percent. The group was included in this analysis because there was a 2 percent likelihood of Outcome D.

Mitigation measures for this group include: survey to acquire additional information and ascertain levels of protection, emphasize clumped green-tree and snag retention in matrix management, and provide for retention of old-growth fragments in watersheds where little remains.

Implementation of these mitigation measures would probably reduce the likelihood of Outcome D to near zero. However, given the uncertainty of global climate change, and the

risk of large-scale fire in these areas, Outcome C will continue to be a possibility, although with a very low likelihood.

Coarse Woody Debris Chewers (south)

Assessment Team ratings for this group reflected uncertainty and concern about the lack of knowledge of the distribution and habitat dynamics of this group, as well as future global change. Many of the species in the group have restricted ranges and previous management activities have already significantly reduced levels of coarse woody debris. Thus, species within this functional group may be vulnerable to extirpation. The group was included in this analysis because the Assessment Team estimated a 4 percent likelihood for Outcome D within the southern portion of the range of the northern spotted owl.

Possible mitigation measures for this group include: survey to acquire additional information and ascertain levels of protection, provide specified amounts of coarse woody debris in matrix management, emphasize clumped green-tree and snag retention in matrix management, modify site treatment practices to minimize soil and litter disturbance, and retain old-growth fragments in watersheds where little remains.

Implementation of these mitigation measures would probably reduce the likelihood of Outcome D to near zero. However, the risk of global change will remain and Outcome C will therefore continue to be a possibility.

Litter and Soil-Dwelling Species (south)

The Assessment Team ratings reflect concern for a largely unknown species assemblage, whose distribution across the landscape is also unknown. Because of the relatively dry environment, extreme fragmentation of habitats, and sensitivity of soil and litter organisms, fire is a significant risk. These organisms are also sensitive to disturbance during site treatment and harvest. The Assessment Team judged that this group had the greatest likelihoods of Outcomes C and D (15 percent and 4 percent, respectively) of any of the arthropods.

Possible mitigation measures for this group include: survey to acquire additional information and ascertain levels of protection, provide specified amounts of coarse woody debris in matrix management, emphasize clumped green-tree and snag retention in matrix management, modify site treatment practices to minimize soil and litter disturbance, retain old-growth fragments where little remains, and protect from grazing.

Implementation of these mitigation measures would probably reduce the likelihood of Outcome D to near zero. However, the risk of global change and high intensity wildfire will remain and Outcome C will therefore continue to be a possibility.

Understory and Forest Gap Herbivores (south)

This is a relatively large group with some species narrowly distributed and others widely distributed. Their distribution reflects the distribution of habitat. Species associated with

forest gaps are especially vulnerable to disturbance. Forest harvest and replanting has produced fragmented vegetation patterns which are different from those resulting from natural disturbance such as fire. As for other groups of arthropods, their taxonomy, distribution and habitat dynamics are not well understood. The Assessment Team estimated a 4 percent likelihood of Outcome D.

Possible mitigation measures for this group include: survey to acquire additional information and ascertain levels of protection, provide specified amounts of coarse woody debris in matrix management, emphasize clumped green tree and snag retention in matrix management, modify site treatment practices to minimize soil and litter disturbance, and retain old-growth fragments where little remains.

Implementation of these mitigation measures would probably reduce the likelihood of Outcome D to near zero. However, the risk of global change and high intensity wildfire will remain and Outcome C will therefore continue to be a possibility.

Estimated Costs and Benefits of Mitigation Measures

However, costs of surveys and studies designed to identify species and more fully understand the habitat dynamics of these groups will be expensive and are difficult to estimate. The cost of an intensive survey of a hypothetical 50 square mile watershed was crudely estimated as \$150,000 annually for 3 years. Not all watersheds would need to be surveyed initially. A sampling strategy could be developed to select representative watersheds. If 20 watersheds were surveyed, the total cost would be \$9,000,000. There may be opportunities to increase efficiency by developing joint sampling protocols for terrestrial mollusks and soil and litter-dwelling arthropods. These latter organisms are the highest survey priority among the arthropods.

Not only would surveys provide knowledge upon which to base management decisions, but they would make important contributions to any national inventory of biodiversity, such as that proposed for coordination by the National Biological Survey.

Habitat management mitigation measures would increase the likelihood of maintaining and improving current levels of biodiversity and function across the federal landscape. Because arthropods were rated by functional group, Outcome D has significantly more serious consequences for arthropods than for those taxa which were rated as individual species. Loss of arthropod ecological function on federal lands would likely result in diminished productivity, and jeopardize sustainability of the system.

F. Mollusks

Ninety-seven species of mollusks failed to pass the screens and were analyzed. All 97 failed on the first screen (the FEMAT rating). No additional species were added as a result of the other screens. The 97 species included 33 land snails, 7 slugs, 54 freshwater snails and 3 freshwater clams. Each of these groups is discussed further below.

Land Snails

Thirty-three land snails were reanalyzed because of the relatively low ratings they received in the FEMAT Report. The rarity and localized distribution of the land snails played an important role in the rating of virtually all these species. Past actions, both on federal and nonfederal lands, also contributed to the ratings for virtually all the land snails. These actions have reduced habitat and populations for virtually all species, and have often exacerbated problems associated with rarity and localized distributions. For 17 species, the uncertain future of the species on nonfederal lands was also a key component of the rating. For 12 species, the lack of specific protection for most known sites under Alternative 9 was an important factor. For eight species, uncertainty about specific guidelines for management of Riparian Reserves in Adaptive Management Areas resulted in the low species rating. Lack of information about species, their locations, and their habitat associations contributed to many of the ratings, and was particularly acute for seven species that are known from very few sites and/or are newly described. Ratings for the mollusks also reflected their vulnerability to relatively minor disturbances. Even in Late-Successional Reserves, species could suffer severe impacts from activities such as thinning as burning.

The most important mitigation measure proposed for the species is to survey for them and provide additional mitigation as needed on a site-specific basis. For a number of species that are found in riparian zones, it is thought that Riparian Reserves will provide substantial protection, and that little additional mitigation will be necessary. On some of these sites, however, some additional mitigation may be necessary. This is especially true of species that normally occur near springs and headwaters, where the smaller riparian protection areas may not provide fully adequate buffering of environmental conditions. Other species are not as strongly associated with riparian zones, or not associated with them at all. Protection of these species may require the establishment of small reserves. In most cases, these reserves will require only tens of acres to provide effective protection for local populations. Some situations could require larger reserves, particularly where sites are subject to desiccation or disturbance. The species for which small reserves may be necessary, and a very crude guess of the overall acreage involved, are shown in Table J2-7. For at least four species, the site-specific mitigation may involve protecting sites from grazing.

Table J2-7. Estimate of acres that would be protected by mitigation measures for land snails and slugs

Species	Acres
<i>Cryptomastix devia</i>	500
<i>Cryptomastix hendersoni</i>	100
<i>Helminthoglypta hertleini</i>	500
<i>Helminthoglypta talmadgei</i>	500
<i>Megomphix hemphilli</i>	100
<i>Monadenia chaceana</i>	500
<i>Monadenia churchi</i>	500
<i>Monadenia troglodytes troglodytes</i>	500
<i>Oreohelix n. species</i>	100
<i>Trilobopsis roperi</i>	100
<i>Trilobopsis tehamana</i>	500
<i>Vespericola euthales</i>	100
<i>Vespericola shasta</i>	500
<i>Deroceras hesperium</i>	500
<i>Hemphillia burringtoni</i>	500
<i>Hemphillia glandulosa</i>	500
<i>Hemphillia pantherina</i>	500
<i>Prophysaon coeruleum</i>	500
<i>Prophysaon dubium</i>	500
Total	7,500

For six species, ratings reflected concerns about the effectiveness of Riparian Reserves in Adaptive Management Areas. For these species, possible mitigation measures include a provision that riparian management in Adaptive Management Areas should provide species protection equivalent to the Riparian Reserves planned outside those areas. This mitigation would be implemented in conjunction with surveys for the species and application of additional site-specific mitigation measures where necessary.

For a few species, other forms of mitigation could take the place of the survey and protect measures. Three species (*Ancotrema voyanum*, *Cryptomastix devia*, and *Vespericola depressa*) would be adequately mitigated by application of Riparian Reserve Scenario 1 throughout the range. Many other measures would provide some benefit for many of the species, but were not considered sufficient to mitigate impacts to the point where the species would pass the screens.

Even with these mitigation measures in place, some problem areas could remain for the land snails. For seven species, the influence of management on nonfederal lands is thought to be so significant that substantial risks of extirpation would remain even with appropriate management of federal lands. For many of the other species, the actual conduct of surveys could become logistically difficult. Thus, there is some potential that surveys would not be completely effective in identifying species locations for protection. This is particularly true of the upland species or species with relatively weak riparian associations.

Slugs

Seven slug species were analyzed because of the ratings they received in the FEMAT Report. The rarity and localized distribution of the slugs played an important role in the rating of virtually all these species. Past actions, both on federal and nonfederal lands, also contributed to the ratings for virtually all the slugs. These actions have reduced habitat and populations for virtually all species, and have often exacerbated problems associated with rarity and localized distributions. For one species, the uncertain future of the species on nonfederal lands was also a key component of the rating. For five species, the lack of specific protection for most known sites under Alternative 9 was an important factor. For two species, uncertainty about specific guidelines for management of Riparian Reserves in Adaptive Management Areas resulted in the low species rating. Lack of information about species, their locations, and their habitat associations contributed to many of the ratings, and was particularly acute for three species that are known from very few sites. Ratings for the slugs also reflected their vulnerability to relatively minor disturbances. Even in Late-Successional Reserves, species could suffer severe impacts from activities such as thinning or burning.

The most important mitigation measure proposed for the species is to survey for them and provide additional mitigation as needed on a site-specific basis. For species that are found in riparian zones, it is thought that Riparian Reserves will provide substantial protection, and that little additional mitigation will be necessary. On some of these sites, however, some additional mitigation measures may be required. This is especially true of species that normally occur near springs and headwaters, where the riparian protection areas may not provide fully adequate buffering of environmental conditions. Other species are not as strongly associated with riparian zones, or not associated with them at all. Protection of these species may require the establishment of small reserves. In most cases, these reserves will require only tens of acres to provide effective protection for local populations. Some situations could require larger reserves, particularly where sites are subject to desiccation or to disturbance. The species for which small reserves may be necessary, and a very crude guess of the overall acreage involved, are shown in Table J2-7.

For two species, ratings reflected concerns about the effectiveness of Riparian Reserves in Adaptive Management Areas. For these species, possible mitigation includes a provision that riparian management in Adaptive Management Areas should provide species protection equivalent to the Riparian Reserves planned outside those areas. This mitigation would be implemented in conjunction with surveys for the species and application of additional site-specific mitigation where necessary.

Even if these possible mitigation measures were implemented, some problem areas could remain for the slugs. For two species (*Hemphillia pantherina* and *Prophysaon coeruleum*), mitigation is more problematic. These species have broad ranges but appear to be distributed sporadically within those ranges. The proposed mitigation for these species is to survey and protect individual sites, but comprehensive surveys would be extremely extensive, labor intensive, and time consuming. Integration with the scheduling of an active timber management program could be difficult. Therefore, the efficacy of this mitigation measure is in question, and some likelihood exists that local populations of the species could be extirpated. More certainty for these species could only be achieved by application of the most conservative alternative.

In general, there are two possible outcomes that would result if the mitigation measures were not applied. The first, and less serious, is that the species would continue to exist on federal land in a distribution similar to its current condition, but that there would be no additional information available on the species. In this case, management actions might be severely hampered by an inability to predict effects on the species, and there would be no opportunity to design more efficient protection measures. The second and more severe outcome would be a reduction in the species distribution, with the ultimate potential that the species would be extirpated from federal land.

Freshwater Snails

There were 54 species of freshwater snails subject to additional analysis. One of the species is classified as a category 2 candidate for federal listing (i.e., *Fluminicola columbiana*) and one (i.e., *Fisherola nuttalli nuttalli*) is a category 3 candidate for federal listing. Thirty-four of these species are still undescribed in science literature. The rarity, restricted distribution and limited information available for most of these species played a major role in their ratings. Forty-three species are associated with springs or spring-influenced habitats, and 25 of these are restricted to springs. Nine species occur only in rivers. The original Assessment Team ratings reflected some concerns on the part of species experts that the standards and guidelines of the selected alternative would be fully implemented. These concerns particularly focused on management of Riparian Reserves, especially in spring habitats which may be severely degraded by diversions and/or grazing by livestock.

Primary Mitigation Measures

The primary possible mitigation measure is to apply Riparian Reserve Scenario 1 in watersheds with anadromous salmonids and trout throughout the range of the northern spotted owl. Prediction of the effects of this mitigation are based on evaluations for Alternative 4 in the FEMAT Report. With this mitigation alone, 12 freshwater snail species

would pass the screens. Application of a single mitigation (survey and manage known sites) was deemed sufficient for (*Lyogyrus* n. sp. 2) to pass all screens. This species is associated with kettle lakes in Washington and is somewhat tolerant of enrichment. Protection around lakes where it occurs should result in successful mitigation.

Successful mitigation for 38 species would require a combination of mitigations. For 19 species, successful mitigation would require surveys to acquire additional information, including distribution and identification of impacts, in combination with protection from impoundments and/or protection of spring habitats from diversions and/or grazing. (Impoundments degrade habitat by slowing current velocities and increasing sedimentation.) For 19 species, all of which are spring associated, implementation of Riparian Reserve Scenario 1 in combination with protection of identified spring habitats from diversions and/or livestock grazing would result in ratings that would pass all screens.

For four species, mitigation measures would be beneficial, but the species would not pass all screens because of concerns for cumulative impacts that are beyond the scope of old-growth ecosystem management on federal lands (e.g., species occur in large river systems or are restricted to sites on private land with little or no expectation that sites on federal land would be discovered by additional surveys).

Freshwater Clams

There were three species of freshwater clams analyzed. Two of the species are classified as category 2 candidates for federal listing (i.e. *Anodonta californiensis* and *Pisidium ultramontanum*). Recent population extinctions have been suffered by each of these species. The increasingly fragmented distribution of each played a major role in assigning ratings to them. *Anodonta californiensis* is extinct in several states where it was formerly widespread and abundant, and *Anodonta wahlametensis* has been eradicated in major portions of river and lake systems where it was previously abundant. Both *Anodonta* species have also been impacted by declining native fish populations such as salmon, upon which they depend for dispersal of their larvae. Some populations of *Pisidium ultramontanum* are now extirpated and the species' range is becoming increasingly fragmented. This species is characteristically found in areas with a high diversity of other aquatic mollusks in relatively pristine habitats.

Primary Mitigation Measures

Mitigation is expected to be effective only for *Pisidium ultramontanum*. In this case, a combination of surveys to better establish the distribution of the species and protection of spring sources from grazing impacts and water diversions is expected to be sufficient.

For the *Anodonta* species which occur in large rivers and lakes, mitigation efforts would be helpful but would not effectively protect these species from cumulative impacts originating on nonfederal lands.

G. Amphibians

Twelve species of amphibians (one species was evaluated independently within two portions of its range) failed to pass the screens and were reanalyzed. These species included 11

salamanders and 1 frog; 7 species are associated with streams and 5 are terrestrial. Twelve of these did not pass the first screen (Assessment Team ratings in the FEMAT report), and 1 additional species was considered for further analysis because of cumulative effects. Mitigations were proposed that are likely to significantly reduce risk to 10 of these species or ranges (such that they would pass the screens); for 3 species or ranges no mitigation could be proposed because the species occur almost exclusively on nonfederal lands (2 species) or occur in such small and disjunct ranges that habitat protection could not be assured (1 species).

Riparian Species

All of these species are associated with small, permanently -flowing headwater streams. The primary reason for the Assessment Team ratings was concern that Riparian Reserve Scenario 2 would not adequately maintain cool, clear water conditions critical for foraging and thermoregulation. Protection of intermittent streams is a key factor in regulating downstream water quality for these species. Wider Riparian Reserves along intermittent streams located outside of Tier 1 Key Watersheds (application of Riparian Reserve Scenario 1, mitigation measures 4 or 5) was judged to result in ratings comparable to those of Alternatives 1 or 4 for five of the eight species or ranges (Cope's giant salamander, black salamander, Cascade torrent salamander, southern torrent salamander, tailed frog). The remaining species could not be fully mitigated to the point they would pass the screens. Van Dyke's salamander (in coastal Oregon) and Columbia torrent salamander occur almost exclusively on nonfederal land and no mitigation on the small portion of federal land inhabited by these species could assure their continued existence on federal lands. For the portion of the Van Dyke's salamander range in the Cascade Range in Washington, increased stream protection would be of significant benefit, but the persistence of the species is questionable because of its extremely limited distribution in very small, disjunct patches and the resulting risk of catastrophic loss of habitat.

Benefits of mitigation for most of these species will be a significantly higher likelihood that habitat conditions will support well-distributed stable populations over the long term. For Van Dyke's Salamander, mitigation will significantly reduce the risk of extirpation of the species, but will not necessarily assure well-distributed populations throughout their potential range.

Two options exist for implementing this possible mitigation measure. Riparian Reserve Scenario 1 could be established throughout the combined ranges of these species (covering about 3.87 million acres of matrix and Adaptive Management Areas lands). Alternatively, surveys could be conducted within these potential ranges to determine presence of the species within specific stream segments. When the species is detected, that segment and all of its intermittent tributaries could be managed with these wider Riparian Reserves. In this way, whatever proportion of the stream network is unoccupied will not require the greater Riparian Reserve width. However, these surveys are costly and time consuming. In general, it will take 2 person-days to determine the presence of these species per mile of stream. Assuming an average of 1 mile of stream per square mile (FEMAT Report, Table V-G-2), full survey would take about 12,000 person-days for all Matrix and Adaptive Management Area lands. With other logistical requirements, this may cost about \$1 million. Costs will be somewhat less if a smaller number of streams can be sampled.

Terrestrial Species

The five terrestrial species failed the screens for a variety of reasons. Two species (clouded salamander and Oregon slender salamander) are associated with large logs. Mitigation measure 11 (provision of additional coarse woody debris in the matrix) would be sufficient to significantly increase the likelihood that these species will be stable and well distributed throughout their ranges. No additional survey work would be needed to implement this mitigation measure.

For the Larch Mountain salamander, the primary reason for failing the screen was that existing protection buffers from the SAT Report, which are incorporated as standards and guidelines in Alternative 9 and other alternatives, may not be adequate to maintain proper understory habitat and microclimatic conditions, especially on south-facing slopes. Therefore, the primary mitigation for this species is mitigation measure 2 (survey and manage occupied sites). For these sites, increasing buffer width from one to two site-potential tree heights would assure such conditions. Application of this mitigation will result in ratings sufficient for this species to pass the screens. Cost of the mitigation will be for surveys (2 person-days per site, assuming a 10-acre site), and the loss of additional timber resulting from the added buffer (assuming 100 sites and 15 acres of added buffer per site would total 1500 acres).

Two additional species, the Siskiyou Mountains salamander and Shasta salamander, are extremely local endemics associated with rocky habitat. Shasta salamander sites are essentially fully protected by existing standards and guidelines that incorporate protection buffers from the SAT Report. Because these sites (primarily limestone outcrops) are disjunct and very small, risk of extirpation due to catastrophic events cannot be ameliorated through mitigation measures. The Siskiyou Mountains salamander is also distributed in small, disjunct populations and is protected by existing standards and guidelines in Alternative 9. Better protection is possible by additional survey and increasing buffers to two site-potential tree heights around occupied sites. Application of these mitigation measures (measures 2 and 3) will essentially eliminate risk of extirpation, but is not sufficient for this species to pass the screen for Outcome A. Costs of this mitigation should be comparable to that listed above for Larch Mountain salamander.

H. Fish

Original FEMAT Ratings

Six anadromous salmonid species/races and three freshwater resident trout species were evaluated by the Assessment Team. The ratings for all these reflect three primary considerations: natural history of the species/race, past actions, and features of the alternative. All species/races are dependent upon high quality freshwater habitat at some point in their life cycle. For anadromous fish, this dependency ranges from 3-6 months for fall chinook salmon to 4 years for steelhead trout. Resident trout spend their entire lives in fresh water.

Salmonid habitat quality and quantity on federal lands is currently degraded throughout the range of the northern spotted owl. As stated in the FEMAT Report, "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (p. V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years).

Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT Report, p. V-68), although possibly at a slower rate than other alternatives.

Mitigation Measures

Possible mitigation measures include: (1) using Riparian Reserve Scenario 1 on intermittent streams in all watersheds, (2) removing all lands in Tier 1 Key Watersheds from the suitable timber base, (3) prohibiting new road construction and requiring a net reduction of road miles in Tier 1 Key Watersheds, (4) Reducing the area available for harvest by removing inventoried roadless areas from the suitable timber base.

The outcomes in the FEMAT Report for all species/races for Alternatives 1 through 6, 8, 9 and 10 were dependent upon funding and implementation of a long-term restoration strategy. Thus, mitigation measures proposed here, with the exception of road removal in Key Watersheds, employ measures other than restoration for reducing risk sufficiently to increase outcomes above those originally assigned in Alternative 9.

Geographic Extent of Mitigation

The potential mitigation measures were intended for implementation throughout the range of the northern spotted owl with the exception of measure 6 which would implement Riparian Reserve Scenario 1 only within the range of coho salmon.

Benefits of Mitigation

1. Application of Riparian Reserve Scenario 1 on all intermittent streams may substantially reduce the risk to habitat especially in coastal areas that "have a large number of at-risk stocks (V-C), large areas of unstable land (figure V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (figure V-25)" (FEMAT Report). If applied throughout the range of the northern spotted owl, Riparian Reserve Scenario 1 would be the most extensive mitigation measure suggested and would achieve outcomes for Alternative 9 similar to those of Alternative 4.

Outcomes for both coho salmon and sea-run cutthroat trout would approach those of Alternative 4 if Riparian Reserve Scenario 1 were applied only within the range of coho salmon. This also covers much of the fall chinook salmon range. All other species/races would benefit where their ranges overlap that of the coho salmon, primarily in the coastal provinces.

2. Removal of Key Watersheds from the suitable timber base would ensure that the system established by Key Watersheds is subjected to limited disturbance from timber harvest and related activities (i.e., road and landing construction). This mitigation measure would be particularly valuable in the short term because the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly benefits stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as these recover. Implementation of this mitigation measure would likely achieve outcomes for Alternative 9 similar to those of Alternative 4.
3. The risk to Key Watersheds would be reduced by prohibiting new road construction and requiring a net reduction in road miles. This mitigation measure addresses one of the primary impacts of timber harvest activities by reducing the potential for road-related disturbance (i.e., increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation measure would probably be less than that derived from removing Key Watersheds entirely from the suitable timber base, it would be valuable.
4. The benefit of removing inventoried roadless areas from the suitable timber base may be somewhat constrained by the coincidence of roadless areas and watersheds containing habitat for these species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT Report, Table V-8, p. V-52). Inventoried roadless areas, by definition, are large (5000 acres minimum, RARE II) with limited disturbance and limited fragmentation. Thus, they generally contain high quality habitat. Roadless areas are often characterized by significant amounts of unstable land. Removal of these areas from the suitable timber base would reduce the potential for generating sediment from erosion and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be in excess of the benefits indicated solely by the number of affected acres due to the exceptionally high quality of habitat provided by roadless areas and the percent overlap of Key Watersheds and roadless areas.
5. Removal of inventoried roadless areas from the suitable timber base, in combination with a prohibition on new road construction and required road removal would likely achieve outcomes that approach those of Alternative 4. Even if this combination of mitigation measures was implemented only in Key Watersheds, all species/races would benefit.

Other Considerations

As stated in the FEMAT Report, "The viability assessment of federal habitat does not directly correspond to population viability of the species considered. This is due in part to impacts or cumulative effects from nonfederal activities" (p. V-70). Examples include: competition from and genetic impacts of hatchery fish, migratory impacts from dams, ocean and freshwater sport and commercial fisheries, ocean conditions, and habitat conditions on nonfederal lands. Federal lands do currently provide most of the highest quality water and fish habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are

generally inadequate to provide well-distributed, stabilized populations of these species throughout the range of the northern spotted owl.

I. Birds

A total of 36 species of birds were assessed by FEMAT. Two species (black-backed woodpecker and common merganser) were selected for additional analysis and possible additional mitigation measures under Alternative 9. The black-backed woodpecker was reviewed because of its rating in the FEMAT report, and the common merganser was reviewed because of concerns about cumulative effects. Effects on the black-backed woodpecker could be mitigated by implementation of the measure for clumping of snags and green trees in the matrix. The common merganser would be benefited by the implementation of Riparian Reserve Scenario 1. However, cumulative effects would remain a concern for the merganser because so much of its breeding habitat is on nonfederal land.

J. Bats

Seven species of bats failed to pass the screens and were reanalyzed. All seven failed on the first screen, which was the Assessment Team rating in the FEMAT Report. In terms of general ecology and predicted responses to possible mitigation measures, these seven species fall into four groups: (1) small, nonmigratory, crevice-roosting bats with widespread distributions that use snags, decadent trees, buildings, bridges, and caves for roosting and hibernating (fringed myotis, long-eared myotis, long-legged myotis, pallid bat); (2) Keen's myotis (a small, rare, endemic, little-known species that occurs only along coastal areas of Puget Sound and the Olympic Peninsula, and whose distribution lies mostly outside of federal lands); (3) hoary bat (a large, solitary, migratory, obligatory foliage-roosting bat with a widespread distribution); and 4) silver-haired bat (a large, migratory, widely-distributed, snag and decadent tree-roosting bat [although it may occasionally use buildings and caves for roosting]). No additional species were added as a result of the other screens.

Small, Crevice-roosting Bats

Although the species in this group have widespread geographic distributions, they failed to pass the screens largely because of demonstrated and hypothesized decreases in bat populations throughout the region. There is a strong concern that loss of snags and decadent trees from the widespread conversion of old-growth forests to young, even-aged plantations, human disturbance and destruction of caves and mines, and demolition of old wooden bridges and buildings have significantly reduced the availability of potential roost sites for crevice-roosting bats. In addition, new evidence is emerging (due to improvements in radio-transmitter miniaturization) that indicates that snags and old, decadent trees are far more important to many bat species for roosting than had been previously suspected, given that such sites are extremely hard to locate without radio telemetry. Pacific Northwest bats forage primarily over riparian zones, especially over streams and ponds. There is also some concern that inadequate riparian protection in previous timber harvest activities have reduced the availability of foraging habitat for bats.

For these species, the most important mitigation measures relate to provisions for additional roost sites within the matrix and protection of roost sites in caves, mines, and wooden structures. Thus, mitigation measure 12, which specifies that green-tree retention be designed to include clumps of trees containing the largest green trees, decadent and leaning live trees, and snags within the cutting unit, is expected to significantly increase the availability of potential roost sites within the matrix. This, in combination with mitigation measure 13, which specifies surveying caves, mines, and old wooden bridges and buildings for the presence of roosting bats and protecting those sites containing bats, would raise scores for this group under Outcome A above the 80 percent level.

Other possible mitigation measures would benefit this group, but not play a significant role in raising their ratings. These include: surveys to gain additional information on bats (mitigation measure 1), added protection for intermittent streams and small wetlands (mitigation measures 5, 6, and 8) which would be expected to provide additional foraging habitat, and protection of additional old-growth or late-successional stands (mitigation measures 9, 18, and 20) which would be expected to provide additional roosting and foraging habitat.

Keen's Myotis

This species failed the screen because of its extremely restricted distribution, its rarity, and the almost complete lack of information available on its ecology and population status. Within the range of the northern spotted owl, this species occurs only in the coastal areas along Puget Sound and the Olympic Peninsula. Thus, its range occurs almost entirely on nonfederal lands. The only area for which management on federal lands may have an impact is within the Olympic Adaptive Management Area.

Because most of its distribution is on nonfederal lands, mitigations on federal lands would be limited in their effect on Keen's myotis. The only mitigation measures that are believed to be of significant benefit to the species are those that concern modifications to prescriptions within the Olympic Adaptive Management Area (mitigation measures 6 and 18). Surveys to gain additional information on this species would also be beneficial (mitigation measure 1).

Hoary Bat

Although this species has a widespread geographic distribution, it failed to pass the screens largely because of demonstrated and hypothesized decreases in bat populations throughout the region. There is a strong concern that the widespread conversion of old-growth forests to young, even-aged plantations and the resulting loss of large, old conifer trees (which are the only sites in which this species roosts), has significantly reduced the availability of potential roost sites for this species. Pacific Northwest bats forage primarily over riparian zones, especially over streams and ponds. There is also some concern that inadequate riparian protection in previous timber harvest activities have reduced the availability of foraging habitat for the hoary bat.

For this species, the most important mitigation measure relates to provisions for additional roost sites within the matrix. Hoary bats require large conifer trees for roosting with foliage

at least three meters off the ground (because of their size, they need to free-fall in order to become airborne). Hoary bats would not be expected to use single trees as roosts due to a lack of environmental buffering and protection from disturbance. Thus, mitigation measure 12, which specifies that green-tree retention be designed to include clumps of trees containing the largest green trees, decadent and leaning live trees, and snags within the cutting unit, is expected to significantly increase the availability of potential roost sites within the matrix. This mitigation is expected to raise the rating for hoary bats under Outcome A above the 80 percent level.

Other possible mitigation measures are expected to benefit this species, but not play a significant role in raising its rating. These include surveys to gain additional information on the species (mitigation measure 1), added protection for intermittent streams and small wetlands (mitigation measures 5, 6, and 8), which would be expected to provide additional foraging habitat, and protection of additional old-growth or late-successional stands (mitigation measures 9, 18, and 20), which would be expected to provide additional roosting and foraging habitat.

Silver-Haired Bat

Although this species has a widespread geographic distribution, it failed to pass the screens largely because of demonstrated and hypothesized decreases in bat populations throughout the region. There is a strong concern that loss of snags and decadent trees from the widespread conversion of old-growth forests to young, even-aged plantations has significantly reduced the availability of potential roost sites for the silver-haired bat. Pacific Northwest bats forage primarily over riparian zones, especially over streams and ponds. There is also some concern that inadequate riparian protection in previous timber harvest activities have reduced the availability of foraging habitat for bats.

For these species, the most important mitigation measures relate to provisions for additional roost sites within the matrix and protection of roost sites in caves, mines, and wooden structures. Thus, mitigation measure 12, which specifies that green-tree retention be designed to include clumps of trees containing the largest green trees, decadent and leaning live trees, and snags within the cutting unit, is expected to significantly increase the availability of potential roost sites within the matrix. This, in combination with mitigation measure 13, which specifies surveying caves, mines, and old wooden bridges and buildings for the presence of roosting bats and protecting those sites containing bats, is expected to raise the rating for silver-haired bats under Outcome A above the 80 percent level.

Other possible mitigation measures are expected to benefit this species, but not play a significant role in raising its scores. These include surveys to gain additional information on bats (mitigation measure 1), added protection for intermittent streams and small wetlands (mitigation measures 5, 6, and 8), which would be expected to provide additional foraging habitat, surveying caves, mines, and old wooden bridges and buildings for the presence of roosting bats and protecting those sites containing bats (mitigation measure 13), and protection of additional old-growth or late-successional stands (mitigation measures 9, 18, and 20), which would be expected to provide additional roosting and foraging habitat.

K. Other Mammals

Four species of mammals failed to pass the screens and were reanalyzed: fisher, marten, and red tree vole (southern species - *Phenacomys pomo*), and red tree vole (northern species - *Phenacomys longicaudus*). All four failed on the first screen, which was the Assessment Team rating in the FEMAT Report. For species that passed the screen for FEMAT rating, additional review was done to determine if cumulative effects posed risks that were not reflected in their rating. These species are elk, western red-backed vole, southern red-backed vole, Townsend's chipmunk, northern flying squirrel, dusky-footed woodrat, shrew-mole, deer mouse, forest deer mouse, and the Pacific/fog shrew complex. All of the species that passed the FEMAT-rating screen have large geographic ranges (6 to 54 million acres), and a large portion of the range of each species is on federal lands (34 to 62 percent). Therefore, none of them were thought to be at high risk due to cumulative effects, and additional analysis was not done for them. No additional species were added as a result of the other screens.

Review of Fisher and Marten Ecology in the Pacific Northwest

Very little is known about the habitat relationships of fishers in the Douglas-fir/western hemlock zone. In the Rocky Mountains and in forested areas of Canada and the eastern United States, fishers occupy a wide variety of forested habitats. Fishers are not dependent upon late-successional forests, but appear rather to require only closed-canopy forests that can be of varying stand ages as long as they contain adequate prey populations; fishers avoid openings and clearcuts. Consequently, and because they are a wide-ranging species with home ranges on the order of 7 square miles, fishers are hypothesized to be particularly sensitive to the effects of forest fragmentation. Fishers were extirpated from most of the eastern United States when vast areas of native forests were cut down and converted to farmlands. Subsequent abandonment of these farms and the reestablishment of second-growth forests has resulted in the restoration of fisher habitat; the species is now sufficiently abundant in many of those States to support a trapping season.

In the Pacific Northwest, fishers are associated with low and mid-elevation forests in which deep snowpacks do not accumulate. The distributional analysis conducted by Aubry and Houston in Washington state showed that west of the Cascade crest, fishers were rarely recorded above 1,200 meters, but that on the east slope, they were recorded up to 2,000 meters in elevation. Forested habitats differ east and west of the crest of the Cascade Range, but these findings (and those from other regions) strongly indicate that fishers do not fare well where dense snowpacks accumulate. Although sample sizes were small, the majority of fisher records in western Washington were from the western hemlock zone and the majority of records from eastern Washington were from the subalpine fir zone. In western Washington, this appears to be the opposite case for martens, where populations in the Cascade Range are densest in the true fir zone, which generally occurs above 1,200 meters.

Negotiating deep snow is energetically very costly for fishers compared to martens, because of their larger body size and different physical adaptations. Martens are able to effectively pursue prey in deep snow and within the subnivean layer, whereas fishers are not. Thus, there is an elevational stratification of optimal habitat for these two species in the western Cascades: optimal habitat for martens is found at high elevations where snowpacks form,

whereas optimal habitat for fishers occurs at low to mid elevations where frequent above-freezing temperatures in the winter prevent the accumulation of snow. Martens are more closely associated with late-successional forests than fishers; however, because past timber-harvesting activities in this region have occurred primarily within the range of optimal habitat for fishers and not martens, the widespread harvesting of old-growth forests has had a significantly greater impact on fishers than on martens. In addition, fishers were overtrapped in Oregon and Washington in the early part of this century (seasons were closed in both States in the 1930's). Thus, marten populations throughout the Cascade Range are generally considered to be healthy, whereas fishers appear to be on the brink of extinction, even after 60 years of protection from trapping.

In addition to a continuous canopy, fishers also prefer forests that have complex physical structure near the forest floor. This structure is important for maintaining prey populations and for providing access to prey during the winter, especially when snow is on the ground. In addition, fishers have very narrow habitat requirements for natal den sites: all natal dens ever found for fishers (and this number is less than 50, range wide), were located in cavities in trees or snags at heights generally exceeding 6 meters. Clearly, only relatively large trees or snags will serve as natal dens: the mean dbh of 32 natal den sites found in Maine was 51 centimeters. Because a female fisher raises her young alone, and must leave the kits to secure prey for herself and for them, it is believed that such sites are necessary for protecting the kits from predators when they are very young. This rather restrictive habitat requirement may have contributed to the decline of fishers in the Pacific Northwest, because the conversion of old-growth Douglas-fir forests to young, even-aged plantations results in the elimination of potential natal den sites.

Thus, fisher populations are believed to have declined on federal lands within the range of the northern spotted owl for two primary reasons, both of which are related to the widespread conversion of old-growth Douglas-fir forests to young plantations: loss of habitat due to forest fragmentation resulting from clearcutting designed in a staggered-setting prescription, and the removal of large, down coarse woody debris and snags from the cutting units.

Because martens are more abundant and more widely distributed than fishers in the Pacific Northwest, more information is available on their habitat requirements and population status. Key habitat features are down coarse woody debris of various decay stages to support prey (primarily *Clethrionomys*), large patches of late-successional forest, and intact forest along riparian zones. Martens preferentially select resting sites in large-diameter trees near streams, either because larger trees tend to occur in more mesic conditions near streams, because of desirable microclimatic conditions there, or because of proximity to prey that are more numerous in streamside habitat.

Martens are relatively abundant in the Cascades Range of Washington and Oregon, but they are infrequent in the Olympic Peninsula and in the coastal regions of Washington, Oregon, and California. As noted above, martens are well adapted to high-elevation conditions, and the lower elevations of coastal portions of these States may never have supported high population densities compared to fishers. Martens are capable of a higher reproductive rate than fishers, and may respond more quickly to habitat restoration. Therefore, populations may recover as cutover forests within reserves attain late-successional conditions over the next 100 years.

Fisher

Fishers failed to pass the screens largely because of concern that inadequate provisions are included in Alternative 9 for significantly reducing regional levels of forest fragmentation and for providing adequate amounts of coarse woody debris within the matrix. Fishers rated less than 80 percent likelihood under Outcome A for Alternatives 1 and 3, which were perceived to provide adequate levels of these habitat features.

Implementing mitigations that would substantially reduce levels of forest fragmentation and increase amounts of down, coarse woody debris in the matrix are expected to raise the rating under Outcome A above 80 percent. There are two combinations of mitigation measures that will accomplish this: mitigation measures 11 and 16, or mitigation measures 11 and 20. Although additional snag provisions (mitigation measure 12) would also benefit fishers by providing additional potential denning sites, it is not believed that denning sites will be a limiting factor under Alternative 9, given proposed levels of Riparian Reserves. Other mitigations that will be of benefit to fishers, but not play a significant role in increasing its score include surveying to acquire additional information (mitigation measure 1), increased protection along intermittent streams and small wetlands (mitigation measures 5, 6, and 8), and protection of additional old-growth and late-successional forests (mitigation measures 9 and 18).

American Marten

The American marten failed to pass the screen primarily because habitat conditions in the matrix would not provide adequate amounts of foraging and denning habitat, especially in the short term until habitat conditions achieve late-successional status within reserved areas. Alternatives that provided greater levels of coarse woody debris or wider Riparian Reserves received higher ratings than those of Alternative 9.

Mitigation for this species would be primarily a combination of increased coarse woody debris in the matrix (mitigation measure 11) and implementation of Riparian Reserve Scenario 1 throughout the species' range (mitigation measure 5). Because the ranges of marten and at-risk fish stocks are largely coincident, riparian protection within the ranges of these fish is sufficient to achieve desired objectives for the marten.

Implementation of this combination of mitigation measures will result in ratings similar to those of Alternative 1, in terms of the likelihood that habitat conditions would be sufficient to support a stable, well-distributed population. Marten populations are quite low in the Olympic Peninsula and the Oregon Coast Range, and there is some chance that populations may not recover in those provinces despite the more favorable habitat conditions that would result from these mitigation measures.

No additional costs would be associated with implementing these mitigation measures for American marten (beyond those already attributed to the mitigation itself).

Red Tree Vole (southern species; *Phenacomys pomo*)

The southern red tree vole failed to pass the screens by a very narrow margin (it was given a likelihood of 78 percent in Outcome A and zero percent for outcome D). The rating was as high as 100 percent for Alternative 1 and ranged from 88 to 95 percent in all other alternatives except 7 and 8. The primary reason for the lower rating in Alternative 9 was concern about retention of sufficient late-successional forest in the matrix, uncertainty about the species distribution and habitat requirements, and the fact that only about 22 percent of the species' range occurs on federal land. Given the very small margin by which this species failed the screen, the Species Analysis Team's subsequent review of the panel notes, and close examination of the distribution of reserved lands and Key Watersheds in California, the team does not find support for the need to further mitigate to meet the screening criteria under Alternative 9. Our reanalysis of habitat conditions for this species leads to the conclusion that it should pass the initial screens. New research has shown that this species nests in later classes of early-successional forest. Regarding the proportion of the species' range on federal lands, 22 percent is significantly large, and although nonfederal management will strongly affect the species rangewide distribution, there is ample opportunity to provide for well-distributed habitat to support stable populations on the federal portion of the species' range. Therefore, no specific mitigation measures are proposed, but a number of measures that are proposed as possible mitigation would benefit the species.

Red Tree Vole (northern species; *Phenacomys longicaudus*)

The northern red tree vole failed to pass the screens because of its apparent strong association with old-growth forests, its very limited dispersal capabilities, and general concern about the extent to which information is lacking on its distribution, habitat requirements, and population status. Because this species is believed to be almost exclusively canopy dwelling, forest fragmentation and isolation of late-successional patches may prevent gene flow and detrimentally affect metapopulation dynamics. The species failed to pass the screens largely because of concern that the provisions of Alternative 9 would not adequately provide for connectivity among late-successional patches for dispersal and gene flow. Although red tree voles are clearly a closed-canopy species, there is conflicting information about the strength of its association with late-successional forests and, in particular, with very large Douglas-fir trees; nests for this species have been found in younger forests. Additional information is urgently needed on their distribution and habitat affinities.

Implementing mitigation measures that would reduce levels of forest fragmentation and provide dispersal corridors for red tree voles, and identify and protect occupied sites will raise the rating under Outcome A above 80 percent. There are two combinations of possible mitigation measures that will accomplish this: mitigation measures 2 and 5, or mitigation measures 2 and 16. Other mitigation measures that would be of benefit to red tree voles, but not play a significant role in increasing its rating, include surveying to acquire additional information (mitigation measure 1), reserving the oldest and largest green trees in prescriptions for green-tree retention (mitigation measure 12), and protection of additional old-growth and late-successional forests (mitigation measures 9, 18, and 20).

Matrices of Benefits From Mitigation Measures for Each Species Group

Introduction

This portion of Appendix J2 represents the results of Step 6: Describe the Benefit Provided to Each Species and/or Species Group by Each Mitigation, as described in more detail earlier in this appendix under Description of the Process.

The objective of this final step in the process was to describe and display the level of benefit provided to each species by each of the possible mitigation measures. This involved reviewing the effect of all 23 consolidated mitigation measures on each species or group of species. Results of this review are displayed in the following tables. The columns represent the 23 mitigation measures, which are listed below. More detail on the specific measures is presented in the section on Methods of Additional Species Analysis in the Final SEIS.

Survey and manage

1. Survey to acquire additional information and ascertain levels of protection
2. Survey for the species and manage individual sites where it is found
3. Manage currently known locations of the species
4. Survey for the species, and apply Riparian Reserve Scenario I guidelines along intermittent streams and small headwaters where the species is found

Riparian Reserves

5. Apply Riparian Reserve Scenario I on intermittent streams with anadromous salmon or trout throughout the range of the owl
6. Apply Riparian Reserve Scenario I on intermittent streams with anadromous salmon or trout throughout the range of coho salmon
7. Ensure that riparian management in Adaptive Management Areas provides species protection equivalent to riparian reserves
8. Apply Riparian Reserve Scenario I to ponds and other open water bodies less than 1 acre

Key Watershed Protection

9. Apply greater protection to Tier 1 Key Watersheds by removing them from the suitable timber base
10. Build no new roads in Tier 1 Key Watersheds

Matrix Management Provisions

11. Provide specified amounts of coarse woody debris in matrix management
12. Emphasize clumped green tree and snag leave in matrix management

13. Provide additional no-harvest buffers around cave entrances
14. Modify site treatment practices, particularly the use of fire and pesticides, and modify harvest methods to minimize soil and litter disturbance
15. Provide dispersal corridors where needed in the range of red tree voles
16. Implement landscape management controls in the matrix to provide for spotted owl dispersal

Miscellaneous Measures With Significant Impact

17. Remove inventoried roadless areas from the suitable timber base
18. Retain all old-growth forests in marbled murrelet zone 1, including Adaptive Management Areas

Other Miscellaneous Measures

19. Provide for retention of old-growth fragments in watersheds where little remains
20. Provide residual habitat areas around spotted owl activity centers
21. Protect sites from grazing
22. Manage recreation areas to minimize disturbance to species
23. Other

The entries in the tables indicate the level of benefit provided to each species or species group by each mitigation measure. The following categories were used to summarize the benefits. The numbers that appear in the cells in the following tables are based on these categories.

1. It is judged that this mitigation would bring the species to the point where it would pass all the initial screens.
2. This mitigation, in combination with another mitigation, would bring the species to the point where it would pass all the initial screens.
3. This mitigation would be beneficial to the species, but it is still likely to fail a screen based on federal habitat management. The species would be more fully protected by another mitigation.
4. This mitigation would be beneficial to the species, but it is still likely to fail a screen based on federal habitat management. Adoption of another alternative is the only mitigation that would be fully successful to pass screens.
5. This mitigation would be beneficial to the species, but it is still likely to fail a screen, and no other alternative or mitigation would bring it to the point where it would pass the screen.
6. This mitigation would benefit the species, but it is still likely to fail a screen due to influences outside the scope of this decision.
7. Mitigation would do harm to the species.

If the cell is left blank, it indicates that mitigation is not applicable to the species, or the measure is not one of the primary mitigations for the species, or the effects of the measure on the species are unknown.

Table J2-8a Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
BRYOPHYTES																							
Individual Species																							
<i>Antitrichia curtipendula</i>					1	1	3											3	2	2			
<i>Diplophyllum plicatum</i>	5		6								6							6					
<i>Douinia ovata</i>					1	1	3											3	2	2			
<i>Kurzia makinoana</i>	2				2	2	2	2			2	2						3	2				
<i>Marsipella emarginata</i> var. <i>aquatica</i>		5	3																			5	
<i>Ptilidium californicum</i>	2	2									2	2							2	2			
<i>Scouleria marginata</i>	2				2	2	2																
<i>Tritomaria exsectiformis</i>		3			5																3	5	

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Boletes																							
Gastroboletus subalpinus			2	2							3	3		3			3		3			3	
Gastroboletus turbinatus			2	2							3	3		2			2	3	3		3		
Chanterelles - Gomphus																							
Gomphus bonarii			2	2							2	2		3				3	3		3		
Gomphus clavatus			2	2							2	2		3				3	3		3		
Gomphus floccosus			2	2							2	2		3				3	3		3		
Gomphus kauffmanii			2	2							2	2		3				3	3		3		
Rare Chanterelles																							
Cantharellus formosus	2	2	2								2	2		3				3	3		3		2
Polyozellus multiplex			2	2	2						3	3		3				3					
Uncommon Coral Fungi																							
Ramaria abietina	3	2	2								3	3		3				3	3		3		
Ramaria araiospora	3	2	2								3	3		3				3	3		3		
Ramaria botryis var. aurantiiramosa	3	2	2								3	3		3				3	3		3		
Ramaria concolor f. tsugina	3	2	2								3	3		3				3	3		3		
Ramaria coulterae	3	2	2								3	3		3				3	3		3		
Ramaria fasciculata var. sparsiramosa	3	2	2								3	3		3				3	3		3		
Ramaria gelatiniaurantia	3	2	2								3	3		3				3	3		3		
Ramaria largentii	3	2	2								3	3		3				3	3		3		
Ramaria rubella var. blanda	3	2	2								3	3		3				3	3		3		
Ramaria rubrievanescens	3	2	2								3	3		3				3	3		3		
Ramaria rubripermanens	3	2	2								3	3		3				3	3		3		
Ramaria suecica	3	2	2								3	3		3				3	3		3		
Ramaria thiersii	3	2	2								3	3		3				3	3		3		
Rare Coral Fungi																							
Ramaria amyloidea	3	5	5								3	3		3				3	3		3		
Ramaria aurantiiscescens	3	5	5								3	3		3				3	3		3		
Ramaria celerivirescens	3	5	5								3	3		3				3	3		3		
Ramaria claviramulata	3	5	5								3	3		3				3	3		3		
Ramaria concolor f. marri	3	5	5								3	3		3				3	3		3		
Ramaria cyaneigranosa	3	5	5								3	3		3				3	3		3		

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Rare Coral Fungi (continued)																							
<i>Ramaria gracilis</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria hilaris</i> var. <i>olympiana</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria loricatum</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria maculatipes</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria rainierensis</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria rubribrunnescens</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria spinulosa</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria stuntzii</i>	3	5	5								3	3		3				3	3	3			
<i>Ramaria verlotensis</i>	3	5	5								3	3		3				3	3	3			
Phaeocollybia																							
<i>Phaeocollybia attenuata</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia californica</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia carmanahensis</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia dissiliens</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia fallax</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia gregaria</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia kauffmanii</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia olivacea</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia oregonensis</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia piceae</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia pseudofestiva</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia scatesiae</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia sipci</i>	3	5	5								3	3		3				3	3	3			
<i>Phaeocollybia spadicea</i>	3	5	5								3	3		3				3	3	3			
Uncommon Gilled Mushrooms																							
<i>Catathelasma ventricosum</i>	2	2									3	3		3				3	3	3			
<i>Cortinarius azureus</i>	2	2									3	3		3				3	3	3			
<i>Cortinarius boulderensis</i>	2	2									3	3		3				3	3	3			
<i>Cortinarius cyanites</i>	2	2									3	3		3				3	3	3			

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Uncommon Gilled Mushrooms (cont.)																							
<i>Cortinarius magnivelatus</i>		2	2								3	3		3				3	3	3			
<i>Cortinarius olympianus</i>		2	2								3	3		3				3	3	3			
<i>Cortinarius spilomius</i>		2	2								3	3		3				3	3	3			
<i>Cortinarius tabularis</i>		2	2								3	3		3				3	3	3			
<i>Cortinarius valgus</i>		2	2								3	3		3				3	3	3			
<i>Dermocybe humboldtensis</i>		2	2								3	3		3				3	3	3			
<i>Hebeloma olympiana</i>		2	2								3	3		3				3	3	3			
<i>Hygrophorus caeruleus</i>		2	2								3	3		3				3	3	3			
<i>Hygrophorus karstenii</i>		2	2								3	3		3				3	3	3			
<i>Hygrophorus vernalis</i>		2	2								3	3		3				3	3	3			
<i>Russula mustelina</i>		2	2								3	3		3				3	3	3			
Rare Gilled Mushrooms																							
<i>Chroogomphus loculatus</i>		5	5								3	3		3			3		3	3			
<i>Cortinarius canabarpa</i>		5	5								3	3		3					3	3			
<i>Cortinarius rainierensis</i>		5	5								3	3		3					3	3			
<i>Cortinarius variipes</i>		5	5								3	3		3					3	3			
<i>Cortinarius verrucisporus</i>		5	5								3	3		3			3		3	3			
<i>Cortinarius wiebeae</i>		5	5								3	3		3			3		3	3			
<i>Tricholoma venenatum</i>		5	5								3	3		3					3	3			
Uncommon Ecto-Polypores																							
<i>Albatrellus ellisii</i>		2	2								3	3		3				2	3	3			
<i>Albatrellus fletii</i>		2	2								3	3		3				2	3	3			
Rare Ecto-Polypores																							
<i>Albatrellus avellaneus</i>		5	5								3	3		3				5	3	3			
<i>Albatrellus caeruleoportunus</i>		5	5								3	3		3				5	3	3			
Tooth Fungi																							
<i>Hydnum repandum</i>		2	2								2	2		2					3	2	2		
<i>Hydnum umbilicatum</i>		2	2								2	2		2					3	2	2		
<i>Phellodon atratum</i>		2	2								2	2		2					3	2	2		
<i>Sarcodon fuscoindicum</i>		2	2								2	2		2					3	2	2		
<i>Sarcodon imbricatus</i>		2	2								2	2		2					3	2	2		

Errata: This information on this page was unintentionally omitted during the compilation of Appendix J2. This table should appear after page J2-61 and before page J2-62.

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Boletes, Low Elevation																							
<i>Boletus piperatus</i>		2	2								3	3		3				2	2	2			
<i>Tylopilus pseudoscaberrimus</i>		2	2								3	3		3				2	2	2			
Rare Zygomycetes																							
<i>Endogone acrogena</i>		5	5								3	3		3				3	3				
<i>Endogone oregonensis</i>		5	5								3	3		3				6	3	3		3	
<i>Glomus radiatum</i>		5	5								3	3		3					3	3		3	
Uncommon Gilled Mushrooms																							
<i>Baeospora myriadophylla</i>		2	2								2	3		3				3	2	2			
<i>Chrysomphalina grossula</i>		2	2								2	3		3				3	2	2			
<i>Collybia bakerensis</i>		2	2								2	3		3				3	2	2			
<i>Favodia gracilipes (rainierensis)</i>		2	2								2	3		3				3	2	2			
<i>Gymnopilus punctifolius</i>		2	2								2	3		3				3	2	2			
<i>Marasmius applanatipes</i>		2	2								2	3		3				3	2	2			
<i>Mycena hudsoniana</i>		2	2								2	3		3				3	2	2			
<i>Mycena lilacifolia</i>		2	2								2	3		3				3	2	2			
<i>Mycena marginella</i>		2	2								2	3		3				3	2	2			
<i>Mycena monticola</i>		2	2								2	3		3				3	2	2			
<i>Mycena overholtsii</i>		2	2								2	3		3				3	2	2			
<i>Mycena quinaultensis</i>		2	2								2	3		3				3	2	2			
<i>Mycena tenax</i>		2	2								2	3		3				3	2	2			
<i>Mythicomycetes corneipes</i>		2	2								2	3		3				3	2	2			
<i>Neolentinus kauffmanii</i>		2	2								2	3		3				2	3	3			
<i>Pholiota albivelata</i>		2	2								2	3		3				3	2	2			
<i>Stagnicola perplexa</i>		2	2								2	3		3				3	2	2			
Rare Gilled Mushrooms																							
<i>Clitocybe subditopoda</i>		5			3						3	3		3				3	3	3			
<i>Clitocybe senilis</i>		5			3						3	3		3				3	3	3			
<i>Neolentinus adherens</i>		5	5		3						3	3		3				3	3	3			
<i>Rhodocybe nitida</i>		5	5		3						3	3		3				3	3	3			
<i>Rhodocybe speciosa</i>		5	5		3						3	3		3				3	3	3			
<i>Tricholomopsis fulvescens</i>		5	5		3						3	3		3				3	3	3			
Noble Polypore																							
<i>Oxyporus nobilissimus</i>		5	5																				

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Bondarzewia Polypores																							
<i>Bondarzewia montana</i>		5	5								3	3		3			3		3			3	
Rare Resupinates and Polypores																							
<i>Aleurodiscus farlowii</i>	5	5	5								3	3		3									
<i>Dichostereum granulosum</i>	5	5	5								3	3		3									
<i>Grandinia microsporella</i>	5	5	5								3	3		3									
<i>Phlebia diffusa</i>	5	5	5								3	3		3									
<i>Polyporoletus sublividus</i>	5	5	5								3	3		3									
<i>Postia rennyi</i>	5	5	5								3	3		3									
<i>Scytinostroma cf. galatinum</i>	5	5	5								3	3		3				5	3				
Uncommon Cup Fungi																							
<i>Cudonia circinans</i>	3	2	2								2	2		2				3	2	2		3	
<i>Cudonia monticola</i>	3	2	2								2	2		2				3	2	2		3	
<i>Gyromitra californica</i>	2										2	2		2									3
<i>Gyromitra esculenta</i>	2										2	3		2									2
<i>Gyromitra infula</i>	2										2	2		2									3
<i>Gyromitra melaleucoides</i>	2										2	2		2									3
<i>Gyromitra montana</i> (syn. <i>G. gigas</i>)	2										2	2		2									3
<i>Otidea leporina</i>	3	2	2		3						2	2		2				3	3	3			
<i>Otidea onotica</i>	3	2	2		3						2	2		2				3	3	3			
<i>Otidea smithii</i>	3	2	2		3						2	2		2				3	3	3			
<i>Plectania melastoma</i>																							
<i>Podostroma alutaceum</i>	3	5	5								3	3		3				3	3	3			
<i>Sarcosoma mexicana</i>	2	2	2															3					2
<i>Sarcosphaera eximia</i>																							
<i>Spathularia flavida</i>	3	2	2								2	2		2				3	2	2		3	
Rare Cup Fungi																							
<i>Aleuria rhenana</i>	3	5	5								3	3		3				3	3	3		3	
<i>Bryoglossum gracile</i>	3	5	5														3					3	
<i>Gelatinodiscus flavidus</i>	3	5	5														3						
<i>Helvella compressa</i>	3	5	5		5						5	5		5				3	3	3			
<i>Helvella crassitunicata</i>	3	5	5		5						5	5		5				3	3	3			
<i>Helvella elastica</i>	3	5	5		5						5	5		5				3	3	3			

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Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Rare Cup Fungi (continued)																							
<i>Helvella maculata</i>	3	5	5		5						5	5						3	3	3			
<i>Neornula pouchetii</i>	3	5	5								3	3		3				3	3	3			
<i>Pithya vulgaris</i>	3	5	5								3	3		3			3						3
<i>Plectania latahensis</i>	3	5	5								3	3		3			3					3	
<i>Plectania milleri</i>	3	5	5								3	3		3			3					3	
<i>Pseudaleuria quinauliana</i>	3	5	5								3	3		3				5	3	3		3	
Club Coral Fungi																							
<i>Clavariadelphus borealis</i>	3	3	3								3	3		3				3	3	3			
<i>Clavariadelphus ligula</i>	3	3	3								3	3		3				3	3	3			
<i>Clavariadelphus lovejoyae</i>	3	3	3								3	3		3				3	3	3			
<i>Clavariadelphus pistillaris</i>	3	3	3								3	3		3				3	3	3			
<i>Clavariadelphus sachalinensis</i>	3	3	3								3	3		3				3	3	3			
<i>Clavariadelphus subfastigiatus</i>	3	3	3								3	3		3				3	3	3			
<i>Clavariadelphus truncatus</i>	3	3	3								3	3		3				3	3	3			
Jelly Mushroom																							
<i>Phlogiotis helvelloides</i>	3	2	2		2						3	3		3									
Rare Boletes																							
<i>Boletus haematinus</i>		5	5								3	3		3			3						
<i>Boletus pulcherrimus</i>		5	5								3	3		3			3	3	3				
<i>Gastroboletus imbellus</i>		5	5								3	3		3			3					5	
<i>Gastroboletus ruber</i>		2	2								3	3		3			3					3	
Branched Coral Fungi																							
<i>Clavulina cinerea</i>	1																						
<i>Clavulina cristata</i>	1																						
<i>Clavulina ornaticipes</i>	1																						
Mushroom Lichen																							
<i>Phytoconis ericetorum</i>	3				3						2	2		2									
Parasitic Fungi																							
<i>Asterophora lycoperdoides</i>		2	2								3	3		3				3	3	3			
<i>Asterophora parasitica</i>		2	2								3	3		3				3	3	3			
<i>Collybia racemosa</i>		2	2								3	3		3				6	3	3			
<i>Cordyceps capitata</i>		2	2								3	3		3				3	3	3			
<i>Cordyceps ophioglossoides</i>		2	2								3	3		3				3	3	3			
<i>Hypomyces luteovirens</i>		2	2								3	3		3				3	3	3			

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
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Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Cauliflower Mushroom																							
<i>Sparassis crispa</i>	3	2	2								2	2		2				3	3	3			2
Moss Dwelling Mushroom																							
<i>Cyphellostereum laeve</i>	3	2	2		2						2	2		2				3	3	3			
<i>Galerina alkinsoniana</i>	3	2	2		2						2	2		2				3	3	3			
<i>Galerina cerina</i>	3	2	2		2						2	2		2				3	3	3			
<i>Galerina heterocystis</i>	3	2	2		2						2	2		2				3	3	3			
<i>Galerina sphagnicola</i>	3	2	2		2						2	2		2				3	3	3			
<i>Galerina vittaeformis</i>	3	2	2		2						2	2		2				3	3	3			
<i>Rickenella setipes</i>	3	2	2		2						2	2		2				3	3	3			
Coral Fungi																							
<i>Clavicornia avellanea</i>	3	2	2								2	2		2				3	3	3			
False Truffles																							
<i>Nivatogastrium nubigenum</i>		2	2								2	3		3									
<i>Rhizopogon abietis</i>		2	2								3	3		3					3				
<i>Rhizopogon atroviolaceus</i>		2	2								3	3		3					3				
<i>Rhizopogon truncatus</i>		2	2								3	3		3				3	3				
<i>Thaxterogaster pingue</i>		2	2								2	2		2				3	2				
Uncommon False Truffle																							
<i>Macowanites chlorinosmus</i>		5	5								3	3		3				3	3	3		3	
Rare False Truffles																							
<i>Alpova alexsmithii</i>		5	5								3	3		3				3					
<i>Alpova olivaceotinctus</i>		6	6																				
<i>Arcangeliiella crassa</i>		5	5								3	3		3				3					
<i>Arcangeliiella lactarioides</i>		5	5								3	3		3				3					
<i>Destuntzia fusca</i>		6	6								3	3						3	6				
<i>Destuntzia rubra</i>		6									3	3						3	6				
<i>Gautieria magnicellaris</i>		5	5								3	3		3				3	5			3	
<i>Gautieria othii</i>		5	5								3	3		3					5			3	
<i>Leucogaster citrinus</i>		5	5								3	3		3				3	3	3		3	
<i>Leucogaster microsporus</i>		5	5								3	3		3				3		3		3	
<i>Macowanites lymanensis</i>		5	5								3	3						3		3			5
<i>Macowanites mollis</i>		5	5								3	3		3					3				

Table J2-8b Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
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Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Rare False Truffles (Continued)																							
<i>Martellia fragrans</i>		5	5								3	3		3			3		3				
<i>Martellia idahoensis</i>		5	5								3	3		3			3		3				
<i>Martellia monticola</i>		5	5								3	3		3			3		3				
<i>Octavianina macrospora</i>		5	5								3	3		3					6			3	
<i>Octavianina papyracea</i>		6									3	3		3				6	3			3	
<i>Rhizopogon brunneiniger</i>		5	5								3	3		3				3	3	3			
<i>Rhizopogon evadens</i> var. <i>subalpinus</i>		5	5								3	3		3			3		3				
<i>Rhizopogon exiguus</i>		5	5								3	3		3			3		3				
<i>Rhizopogon flavofibrillosus</i>		5	5								3	3		3				5	5			3	
<i>Rhizopogon inquinatus</i>		5	5								3	3		3					3			3	
<i>Sedecula pulvinata</i>		5	5								3	3		3			3		3				
Undescribed Taxa, Rare & False Truffles																							
<i>Alpova</i> sp. nov. #Trappe 1966		5	5								3	3		3					3				
<i>Alpova</i> sp. nov. #Trappe 9730		5	5								3	3		3					3				
<i>Arcangeliiella</i> sp. nov. #Trappe 12359		5	5								3	3		3				5	3	3			3
<i>Arcangeliiella</i> sp. nov. #Trappe 12382		5	5								3	3		3					3				
<i>Chamonixia pacifica</i> sp. nov. #Trappe 12768		5	5								3	3		3				6	3				
<i>Elaphomyces</i> sp. nov. #Trappe 1038		5	5								3	3		3				5	3	3			3
<i>Gastroboletus</i> sp. nov. #Trappe 2897		5	5								3	3		3					3				
<i>Gastroboletus</i> sp. nov. #Trappe 7515		5	5								3	3		3			3		3			3	
<i>Gastrosuillus</i> sp. nov. #Trappe 7516		5	5								3	3		3			3		3				
<i>Gastrosuillus</i> sp. nov. #Trappe 9608		5	5								3	3		3			3		3			3	
<i>Gymnomyces</i> sp. nov. #Trappe 1690, 1706, 1710		5	5								3	3		3			3		3				
<i>Gymnomyces</i> sp. nov. #Trappe 4703, 5576		5	5								3	3		3			3		3			3	
<i>Gymnomyces</i> sp. nov. #Trappe 5052		5	5								3	3		3				3	3				
<i>Gymnomyces</i> sp. nov. #Trappe 7545		5	5								3	3		3			3		3	3			
<i>Hydnotrya</i> sp. nov. #Trappe 787, 792		5	5								3	3		3			3		3			3	3
<i>Hydnotrya subnix</i> sp. nov. #Trappe 1861		6	6								3	3		3					3				
<i>Martellia</i> sp. nov. #Trappe 1700		5	5								3	3		3			3		3			3	
<i>Martellia</i> sp. nov. #Trappe 5903		5	5								3	3		3			3		3			3	3
<i>Martellia</i> sp. nov. #Trappe 649, 311		5	5								3	3		3			3					3	
<i>Octavianina</i> sp. nov. #Trappe 7502		5	5								3	3		3			3		3			3	
<i>Rhizopogon</i> sp. nov. #Trappe 1692		5	5								3	3		3			3		3			3	3

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Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FUNGI																							
Undescribed Taxa, Rare & False Truffles (cont)																							
Rhizopogon sp. nov. #Trappe 1698		5	5								3	3		3			3		3			3	
Rhizopogon sp. nov. #Trappe 9432		5	5								3	3		3				3					
Thaxterogaster sp. nov. #Trappe 4867,6242,7427,7962,8520		5	5								3	3		3				3	3			3	
Tuber sp. nov. #Trappe 12493		5	5								3	3		3				3	3			3	
Tuber sp. nov. #Trappe 2302		5	5								3	3		3				3	3			3	
Rare Truffles																							
Balsamia nigrens		6	6								3	3		3					6			3	
Choiromyces alveolatus		5	5								3	3		3			3		3				
Choiromyces venosus		6	6								3	3		3					6				
Elaphomyces anthracinus		5	5								3	3		3					3			5	
Elaphomyces subviscidus		5	5								3	3		3					3			5	
Chanterelles																							
Cantharellus cibarius		2	2								2	2		3				3	3	3			2
Cantharellus subalbidus		2	2								2	2		3				3	3	3			2
Cantharellus tubaeformis		2	2								2	2		3				3	3	3			2

Table J2-8c Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
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Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LICHENS																							
Rare Forage (arboreal)																							
<i>Bryoria tortuosa</i>		5																5					
Oceanic Influenced																							
<i>Cetraria californica</i>		2	2									5						2				3	
<i>Heterodermia leucomelos</i>		2	2									3						2				3	
<i>Loxospora</i> sp nov. "corallifera" (Brodo in edit)		2	2									3						2				3	
<i>Pyrrhospora quereia</i>		2	2									3						2				3	
Rare Leafy (arboreal)																							
<i>Hypogymnia duplicata</i>		5										3						5	3				
<i>Tholurna dissimilis</i>		5																					
Rare Nitrogen-fixing																							
<i>Dendriscoaulon intricatulum</i>		5										3					5		3	3			3
<i>Lobaria hallii</i>		5										3							3	3			3
<i>Lobaria linita</i>		5										3					5		3	3			3
<i>Nephroma occultum</i>		5										3					5		3	3			3
<i>Pannaria rubiginosa</i>		5										3							3	3			3
<i>Pseudocyphellaria rainierensis</i>		5										3					5		3	3			3
Nitrogen-fixing																							
<i>Lobaria oregana</i>	3				3				3			2		3			3	2	3	2			3
<i>Lobaria pulmonaria</i>	3				3				3			2		3			3	2	3	2			3
<i>Lobaria scrobiculata</i>	3				3				3			2		3			3	2	3	2			3
<i>Nephroma bellum</i>	3				3				3			2		3			3	2	3	2			3
<i>Nephroma helveticum</i>	3				3				3			2		3			3	2	3	2			3
<i>Nephroma laevigatum</i>	3				3				3			2		3			3	2	3	2			3
<i>Nephroma parile</i>	3				3				3			2		3			3	2	3	2			3

Table J2-8c Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
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Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LICHENS																							
Nitrogen-fixing (continued)																							
<i>Nephroma resupinatum</i>	3				3				3			2		3			3	2	3	2			3
<i>Pannaria leucostictoides</i>	3				3				3			2		3			3	2	3	2			3
<i>Pannaria mediterranea</i>	3				3				3			2		3			3	2	3	2			3
<i>Pannaria saubinetii</i>	3				3				3			2		3			3	2	3	2			3
<i>Peltigera collina</i>	3				3				3			2		3			3	2	3	2			3
<i>Peltigera neckeri</i>	3				3				3			2		3			3	2	3	2			3
<i>Peltigera pacifica</i>	3				3				3			2		3			3	2	3	2			3
<i>Pseudocyphellaria anomala</i>	3				3				3			2		3			3	2	3	2			3
<i>Pseudocyphellaria anthraxis</i>	3				3				3			2		3			3	2	3	2			3
<i>Pseudocyphellaria crocata</i>	3				3				3			2		3			3	2	3	2			3
<i>Sticta beauvoisii</i>	3				3				3			2		3			3	2	3	2			3
<i>Sticta fuliginosa</i>	3				3				3			2		3			3	2	3	2			3
<i>Sticta limbata</i>	3				3				3			2		3			3	2	3	2			3
Pin Lichens																							
<i>Calicium abietinum</i>	3								3			2					3	3	3	2			
<i>Calicium adacquatum</i>	3								3			2					3	3	3	2			
<i>Calicium adpersum</i>	3								3			2					3	3	3	2			
<i>Calicium glaucellum</i>	3								3			2					3	3	3	2			
<i>Calicium viride</i>	3								3			2					3	3	3	2			
<i>Chaenotheca brunneola</i>	3								3			2					3	3	3	2			
<i>Chaenotheca chrysocephala</i>	3								3			2					3	3	3	2			
<i>Chaenotheca ferruginea</i>	3								3			2					3	3	3	2			
<i>Chaenotheca furfuracea</i>	3								3			2					3	3	3	2			
<i>Chaenotheca subroscida</i>	3								3			2					3	3	3	2			
<i>Chaenothecopsis pusilla</i>	3								3			2					3	3	3	2			
<i>Cyphelium inquinans</i>	3								3			2					3	3	3	2			
<i>Microcalicium arenarium</i>	3								3			2					3	3	3	2			
<i>Mycocalicium subtile</i>	3								3			2					3	3	3	2			
<i>Stenocybe clavata</i>	3								3			2					3	3	3	2			
<i>Stenocybe major</i>	3																						

Table J2-8c Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LICHENS																							
Rare Rock Lichens																							
<i>Pilophorus nigricaulis</i>	3	5																3					
<i>Sticta arctica</i>	3	5																3					
Riparian Lichens																							
<i>Cetrelia cetrarioides</i>	3				1	1	3		3														
<i>Collema nigrescens</i>	3				1	1	3		3														
<i>Leptogium burnetiae</i> var. <i>hirsutum</i>	3				1	1	3		3														
<i>Leptogium cyanescens</i>	3				1	1	3		3														
<i>Leptogium saturninum</i>	3				1	1	3		3														
<i>Leptogium teretiusculum</i>	3				1	1	3		3														
<i>Platismatia lacunosa</i>	3				1	1	3		3														
<i>Ramalina thrausta</i>	3				1	1	3		3														
<i>Usnea longissima</i>	3				1	1	3		3														
Aquatic Lichens																							
<i>Dermatocarpon luridum</i>	3	1			1	1																	
<i>Hydrothyria venosa</i>	3	1			1	1																	
<i>Leptogium rivale</i>	3	1			1	1																	
Rare Oceanic Influenced																							
<i>Bryoria pseudocapillaris</i>		5	5									3						3				3	
<i>Bryoria spirifer</i>		5	5									3						3				3	
<i>Bryoria subcana</i>		5	5									3						3				3	
<i>Buellia oidealea</i>		5	5									3						3				3	
<i>Erioderma sorediatum</i>		5	5									3						3				3	
<i>Hypogymnia oceanica</i>		5	5									3						3				3	
<i>Leioderma sorediatum</i>		5	5									3						3				3	
<i>Leptogium brevissonii</i>		5	5									3						3				3	
<i>Niebla cephalota</i>		5	5									3						3				3	
<i>Pseudocyphellaria mougeotiana</i>		5	5									3						3				3	
<i>Teloschistes flavicans</i>		5	5									3						3				3	
<i>Usnea hesperia</i>		5	5									3						3				3	

Table J2-8d Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
VASCULAR PLANTS																							
Individual Species or Ranges																							
<i>Abies lasiocarpa</i> (California)																							
<i>Allotropa virgata</i>	2	1	1								2			2			2	2	2	3			
<i>Arceuthobium tsugense</i>	2	1	1															3					
<i>Aster vialis</i>	2	1	3																				
<i>Bensoniella oregana</i> (California)		6			3	3												6					
<i>Botrychium minganense</i>	2	1	1		3	3			3	3							3		3				
<i>Botrychium montanum</i>	2	1	3	3	3	3			3	3							3		3				
<i>Clintonia andrewsiana</i>		1	1															2					
<i>Coptis asplenifolia</i>		5																5					
<i>Coptis trifolia</i>	2	1	3		3			3															
<i>Corydalis aquae-gelidae</i>	2	1	3	2	3	3			3	3							2						
<i>Cypripedium fasciculatum</i>		5	5																	3			
<i>Cypripedium montanum</i>		4	4																	3			
<i>Galium kamtschaticum</i>	2	1	2					2											2				
<i>Habenaria orbiculata</i>	2	1	2								2								2				
<i>Pedicularis howellii</i>	2	1	2											2							2		
<i>Scolopus biglovei</i>		1	1															2					

Table J2-8e Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
ARTHROPODS																							
Groups or Ranges																							
Canopy herbivores (South range)	2											2				2			2				
Coarse wood chewers (South range)	2										2	2		2					2				
Litter & soil dwelling species (South range)	2										2	2		2					2		2		
Understory & forest gap herbivores (South range)	2										2	2		2					2				

Table J2-8f Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MOLLUSKS																							
Land Snails																							
Ancotrema voyanum	2				1	3	2														2		
Cryptomastix devia		2			1	3	2																
Cryptomastix hendersoni		2	2		3																		
Helminthoglypta hertleini		6							3	3							3						
Helminthoglypta talmadgei		1							3	3							3						
Megomphix californicus	2						2																
Megomphix hemphilli		2					2																
Monadenia callipeplus	1																						
Monadenia chaceana		6	6																				
Monadenia churchi		2																					
Monadenia fidelis celeuthia	1																						
Monadenia fidelis flava	6																						
Monadenia fidelis klamathica	2																			2			
Monadenia fidelis leonina	1																						
Monadenia fidelis minor		2	2																				
Monadenia fidelis ochromphalus	2																			2			
Monadenia fidelis salmonensis	1				1																		
Monadenia scottiana	1																						
Monadenia setosa	2						2																
Monadenia troglodytes troglodytes		2	2																				
Monadenia troglodytes wintu		2	2																			2	
Oreohelix n. sp.		2	2																				
Pristiloma artium crateris		2																			2		
Trilobopsis roperi		6	6																				
Trilobopsis tehamana		2	2																				
Vertigo n. sp.		6	6																				
Vespericola depressa	1			1	1																		
Vespericola euthales	1																						
Vespericola pressleyi		2	2				2																
Vespericola shasta		2	2									3											2
Vespericola sierranus	6				6																		
Vespericola undescribed #1	1																						
Vespericola undescribed #2	6																						

Table J2-8f Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MOLLUSKS																							
Slugs																							
<i>Deroceras hesperium</i>		2	2																				
<i>Hemphillia barringtoni</i>		2	2				2																
<i>Hemphillia glandulosa</i>		2	2				2																
<i>Hemphillia malonei</i>		2	2																				
<i>Hemphillia pantherina</i>		5	5																				
<i>Prophysaon coeruleum</i>		4	4																				5
<i>Prophysaon dubium</i>		2	2																				
Freshwater Snails																							
<i>Fisherola nuttalli nuttalli</i>	6																						
<i>Fluminicola columbiana</i>	6																						
<i>Fluminicola n. sp. 1</i>		2			2																2		2
<i>Fluminicola n. sp. 2</i>		2			2																2		2
<i>Fluminicola n. sp. 3</i>		2			2																2		2
<i>Fluminicola n. sp. 4</i>					1																		
<i>Fluminicola n. sp. 5</i>					1																		
<i>Fluminicola n. sp. 6</i>					1																		
<i>Fluminicola n. sp. 7</i>					1																		
<i>Fluminicola n. sp. 8</i>					1																		
<i>Fluminicola n. sp. 9</i>					1																		
<i>Fluminicola n. sp. 10</i>					1																		
<i>Fluminicola n. sp. 11</i>		2			2																2		2
<i>Fluminicola n. sp. 12</i>	2																					2	2
<i>Fluminicola n. sp. 13</i>	2																					2	2
<i>Fluminicola n. sp. 14</i>		2			2																		2
<i>Fluminicola n. sp. 15</i>		2			2																		2
<i>Fluminicola n. sp. 16</i>		2			2																		2
<i>Fluminicola n. sp. 17</i>		2			2																		
<i>Fluminicola n. sp. 18</i>		2			2																		
<i>Fluminicola n. sp. 19</i>		2			2																2		2
<i>Fluminicola n. sp. 20</i>		2			2																2		2
<i>Fluminicola seminalis</i>		2			2																2		2
<i>Helisoma newberryi newberryi</i>					1																		

Table J2-8f Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MOLLUSKS																							
Freshwater Snails (continued)																							
<i>Juga (C.) acutiflosa</i>					1																		
<i>Juga (C.) occata</i>					1																		
<i>Juga (J.) n. sp. 1</i>	2																						2
<i>Juga (J.) n. sp. 3</i>	2																						2
<i>Juga (O.) n. sp. 1</i>	2																						2
<i>Juga (O.) n. sp. 2</i>		2			2																		2
<i>Juga (O.) n. sp. 3</i>		2			2																		2
<i>Juga (Oreobasis) chacei</i>	2																						2
<i>Juga (Oreobasis) orickensis</i>					1																		
<i>Juga hemphilli dallesensis</i>	2																						2
<i>Juga hemphilli hemphilli</i>	2																						2
<i>Juga hemphilli n. subsp. 1</i>	2																						2
<i>Lanx alta</i>					1																		
<i>Lanx klamathensis</i>	2																						2
<i>Lanx patelloides</i>	2																						2
<i>Lanx subrotundata</i>	2																						2
<i>Lyogyryus n. sp. 1</i>		2			2																		2
<i>Lyogyryus n. sp. 2</i>		1																					
<i>Lyogyryus n. sp. 3</i>		2			2																		2
<i>Lyogyryus n. sp. 4</i>	2																						2
<i>Lyogyryus n. sp. 5</i>	2																						2
<i>Lyogyryus n. sp. 6</i>	2																						2
<i>Physella columbiana</i>	6																						
<i>Pyrgulopsis archimedis</i>	2																						2
<i>Pyrgulopsis intermedia</i>					1																		
<i>Pyrgulopsis n. sp. 1</i>	2																						2
<i>Vorticifex klamathensis klamathensis</i>	2																						2
<i>Vorticifex klamathensis sinisini</i>		2			2																		2
<i>Vorticifex n. sp. 1</i>		2			2																		2
<i>Vorticifex neritoides</i>	6																						
Freshwater Clams																							
<i>Anodonta californiensis</i>	6																						
<i>Anodonta wahlametensis</i>	6																						
<i>Pisidium (C.) ultramontanum</i>	2																						2

Table J2-8g Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
AMPHIBIANS																							
Riparian																							
Black salamander	3	3	3	1	1	3			3	3							3	3					
Cascade torrent salamander (R. cascadae)	3	3	3	1	1				3	3							3	3					
Columbia torrent salamander (R. kezeri)				6	6												3	3					
Cope's giant salamander	3	3	3	1	1	3			3	3							3	3					
Southern torrent salamander (R. variegatus)	3	3	3	1	1	3			3	3							3	3					
Tailed frog	3	3	3	1	1	3			3	3							3	3					
Van Dyke's salamander (Cascades)	5	5		5																			
Van Dyke's salamander (Coastal, Oly. Penin.)				6	6																		
Terrestrial																							
Clouded salamander (California)	3	3							3		1			3			3	1					
Larch Mountain salamander	3	1							3					3			3		3				
Oregon Slender salamander	3	3	3						3		1			3			3						
Shasta salamander	5	5																					
Siskiyou Mountains salamander	5	5																					

Table J2-8h Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FISH																							
Races/Species/Groups																							
Bull Trout					1				1	1							1						
Coho Salmon					1	1		1	1	2							2	1					
Fall Chinook Salmon					1	3			1	2							2	3					
Resident Cutthroat Trout/Rainbow Trout					1	3			1	2							2	3					
Sea-run Cutthroat Trout					1	1		1	1	2							2	1					
Spring Chinook/Summer Steelhead Trout					1	3			1	2							2	3					
Winter Steelhead Trout				.	1	3			1	2							2	3					

Table J2-8i Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
BIRDS																							
Individual Species																							
Black-backed Woodpecker		3	3									2	2						2	3			
Common Merganser					6	6	6											6					

Table J2-8j Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
BATS																							
Individual Species																							
Fringed myotis	3				3	3		3	3			2	2					3		3			
Hoary bat	3				3	3		3	3			1						3		3			
Keen's myotis	3						6											6					
Long-eared myotis	3				3	3		3	3			2	2					3		3			
Long-legged myotis	3				3	3		3	3			2	2					3		3			
Pallid bat	3				3	3		3	3			2	2					3		3			
Silver-haired bat	3				3	3		3	3			1	3					3		3			

Table J2-8k Level of Benefit Afforded to Individual Species or Functional Groups by the 23 Possible Mitigation Measures.
Refer to the Introduction of this Table and the Description of the Process for Further Explanation of Benefits and Mitigation Measures.

Possible Mitigation Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
OTHER MAMMALS																							
Individual Species																							
Fisher	3				3	3		3	3		2	3				2		3		2			
Marten	3				2				3		2	3				3		3		3			
Red tree vole (<i>P.longicaudus</i>)	3	2			2				3			3				2		3		3			

Basis for Rating and Mitigation for Individual Species

This portion of Appendix J2 represents the results of Step 2: Describe in Detail the Basis for the Species Rating and/or the Basis for Concern About the Cumulative Effects, Step 3: Describe the Possible Mitigation Measures for Each Species, and Step 4: Describe the Benefits of the Possible Mitigation Measures. Each of these steps is described in more detail earlier in this appendix under Description of the Process.

For each of the species selected in the four screens, a detailed description and interpretation was provided of the basis for the species rating in the FEMAT Report, the basis for reassessment given proposed changes to Alternative 9, and/or the basis for concern about cumulative effects. In the process of completing these descriptions, original assessment panel notes were consulted, as well as detailed maps of Alternative 9 and of species' ranges and locations; original literature sources for the species; and information on the portion of the species' range and/or locations included within reserves. Updated information was sought from State Natural Heritage Program data bases, and new herbarium searches were conducted for lichens.

The additional analysis for some species was more detailed than the original assessment, and/or included new information that was not reasonably available at the time of the original assessment. In some cases, this additional information provided the basis for reinterpreting the assessments in the FEMAT Report. Where this occurred, it is noted in the species discussions that follow.

In developing the detailed descriptions of the species' rating, the Species Analysis Team considered the contribution that each of the following factors may have made to the original rating.

- **Natural History** - In some cases, the species may be known from only a few sites or from within a very limited distribution. In other cases, the species habitat, and thus its distribution, may be naturally fragmented.
- **Past Actions** - In some cases, the species' habitat has been severely impacted and/or fragmented by previous actions, and can only recover slowly. In other cases, the species has already been extirpated from significant parts of its range, and recolonization is problematic.
- **Species' Range** - A large portion of a species' range may lie outside the range of the northern spotted owl. In other cases, a large portion of a species' range may occur on nonfederal land.
- **Non-habitat Factors** - Factors such as hunting, fishing, air and water quality, and climate can influence the likely future for some species.
- **Inadequate Information** - In some cases, the species' rating may be largely a reflection of scientific uncertainty due to the lack of available information about a species.
- **Features of the Alternative** - The specific features of the alternatives were intended to play a primary role in determining the species' rating. For this analysis, the Species

Analysis Team attempted to detail the specific features of the alternative that most influenced the original rating. This information was a critical building block for designing mitigation measures.

In addition to the above factors, the possible role of cumulative effects was examined for each species in this analysis. This included species that were specifically analyzed because of cumulative effects, as well as species that were analyzed based on other screens. The Species Analysis Team assessed the role that cumulative effects might play in determining the species' future, and whether cumulative effects had already been accounted for in the FEMAT rating. Even though the original Assessment Team ratings of habitat outcomes for federal land were supposed to be independent of cumulative effects, in practice it was very difficult to separate federal habitat from other influences on some species. In this most recent analysis, discussions of cumulative effects include the effects of species' range, non-federal habitat management, and non-habitat factors.

Based on the above discussions, a summary statement was provided describing the likely future outcome for each species. This summary provided clarification of the reasoning behind the species rating in the FEMAT Report. The summaries enabled the Species Analysis Team to distinguish between situations, for example, where a species received a particular rating because of naturally fragmented habitat, and situations where a species received a particular rating because the proposed action in the alternative was likely to further fragment its habitat. The summaries also provided new information on cumulative effects and likely effects of changes that had been proposed to Alternative 9.

Possible mitigation measures were developed in conjunction with individual species experts. The mitigation measures were designed primarily to modify features of Alternative 9, but any or all of these mitigation measures could be combined with any of the alternatives. In many cases, the possible measures are simply components of other alternatives in which the species outcome rated higher. In other cases, the mitigation measure would prescribe actions to be taken when very localized actions are planned. These mitigation measures were intended to address the rare and narrowly-distributed species. Finally, some mitigation measures were intended to offset the possible negative consequences of cumulative effects.

In all cases, the overall objective of possible mitigation measures was to bring the species to a point where it would pass through all the screens described in Step 1 (see Description of the Process earlier in this appendix). In some cases, this objective was either not possible, or could only be accomplished by adoption of another alternative. In these cases, that conclusion is stated, but possible mitigation measures have been presented that would provide some benefit to the species. Mitigation measures have been described as specifically as possible to help determine the benefits of the mitigation.

Benefits of the possible mitigation measures would have been best described by conducting a new species assessment using a similar process as that described in the FEMAT Report. However, a number of factors prevented such a reassessment. Instead, the Species Analysis Team provided qualitative statements about the efficacy of mitigation that was proposed for each species. Wherever possible, information was provided on the effectiveness of each component of the mitigation. For example, if species surveys are an important component of the mitigation measures, the reliability of those surveys in locating the species is described. Where several different possible levels of mitigation are proposed, the benefits of each of them is described individually.

The species summaries for fungi were prepared using information provided under contract by Dr. Joe Ammirati, Botany Department, University of Washington, Dr. Bill Denison, Department of Botany and Plant Pathology, Oregon State University, and Dr. Jim Trappe, Department of Forest Sciences, Oregon State University. These individuals also consulted other knowledgeable people, herbaria records and the literature to provide as much information as was possible or available within a very short timeframe. The species summaries that follow were prepared by Robin D. Leshner who assumes responsibility for their content and interpretation.

A table of contents is provided at the beginning of each species group to help the reader more easily locate specific species or groups of species.

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-
- I. **Species.** *Antitrichia curtipendula* [Moss] (One of two species in Canopy Interior group)
- II. **FEMAT Rating.** 73-27-0-0
- III. **Modifications due to changes in Alternative 9.** None.
- IV. **Explanation of Rating.**
- A. **Natural History.** This species is best developed on branches and limbs in the interior of the coniferous canopy, in cool wet forests along the coast and on stream terraces subject to cold air drainage and fog penetration. Its presence in the understory usually results from litterfall. Its large biomass may play a "keystone" role in mineral cycling and regulation of microclimate in the canopy. It is also used for nesting sites by the marbled murrelet and red tree vole.
- B. **Past Actions.** Roading and logging on stream terraces has reduced occurrences and fragmented some populations.
- C. **Species Range.** Distributed throughout the region west of the Cascades; circumboreal. About 25 percent of the populations occur on non-federal hardwood stands in western interior valleys.
- D. **Non-habitat Factors.** Declining air quality and acid precipitation will cause losses on hardwoods in western interior valleys, and will elevate concern for this species on federal land. The species is known to be in decline from air pollution in Sweden. Its location on stream bottoms in the Pacific Northwest makes it vulnerable to air pollution, because aerosols concentrate in valleys.
- E. **Inadequate Information.** The keystone role of this species in canopy dynamics needs more study and was responsible for some concern about the ratings.
- F. **Features of the Alternative.** Riparian buffers were thought to have been adequate to protect many occurrences of this species, but buffer widths may be inadequate to protect larger occurrences on broad floodplains and stream terraces.
- V. **Cumulative Effects Assessment.** Despite projected adequate protection on federal lands, loss of 25 percent of populations (declining hardwood habitat and effects of declining air quality) on non-federal lands may elevate the importance of this species on federal lands.
- VI. **Summary.** This is a common species, but cumulative effects on non-federal land may raise concerns about this species' viability on federal lands.
- VII. **Mitigation.** Mitigation can offset concerns about cumulative effects on non-federal land.
- A. **Geographic extent.** Throughout region.

B. Specific habitats. Riparian buffers, stream terraces.

C. Mitigation measures. Riparian buffers should be extended to encompass entire stream terraces, as much of the biomass of this species exists beyond one or two tree lengths from streams. Because so many floodplain acres have been lost to roads, no new roads should be constructed on them. Stands on these sites should not be thinned or harvested. It is important to preserve shading and moisture retention in the canopy, to promote the growth of this species.

D. Benefits. Mitigation will stabilize populations on federal lands at existing levels, while populations on non-federal land are anticipated to decline. Not much can be done to offset effects of air pollution originating from non-federal land. Protection of existing populations will enable dispersal to developing late-successional or old-growth stands elsewhere in the landscape.

I. Species. Liverwort (*Diplophyllum plicatum*)

II. FEMAT Rating. 10-30-30-30

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating.

A. Natural History. Species grows on bark, decaying wood and thin soil over rock. Requires cool, moist conditions.

B. Past Actions. Coastal occurrences in Sitka spruce zone have been decimated by logging old-growth spruce. Only known Oregon occurrences are from old-growth reserves.

C. Species Range. Coastal Oregon, Olympic Peninsula, Washington Cascades, northward to Alaska; Asia. Rare and local in our region. Half of occurrences in Oregon are on non-federal land.

D. Non-habitat Factors. Liverworts are especially sensitive to acid precipitation and global climate change. Air quality is not much of a threat in coastal localities, but could be detrimental to Cascade populations in Washington.

E. Inadequate Information. Knowledge of distribution and ecology within the region is inadequate.

F. Features of the Alternative. Riparian buffers and reserves may protect the species in the western Cascades of Washington, but its distribution in the state is too poorly known to assess with certainty. Loss of habitat on the coast, and non-federal ownership of much of remaining old-growth there, largely negate the effectiveness of the alternative.

- V. **Cumulative Effects Assessment.** In Oregon, 50 percent of the known populations occur on non-federal land. Losses in non-federal land would raise the importance of populations on federal land.
- VI. **Summary.** This is a rare species whose distribution is spotty and poorly known. In Oregon, it is not well protected by the alternative, primarily because of a coastal distribution on non-federal land. The distribution of existing populations in Washington is not well known.
- VII. **Mitigation.** The species' rarity may preclude the effectiveness of mitigation.
- A. **Geographic extent.** Coastal Oregon and Washington, Washington Cascades
- B. **Specific habitats.** Bark of hardwoods and conifers, soil over rock, rotting logs. Cool, moist sites with much organic matter available.
- C. **Mitigation measures.** Manage more acres for late successional and old-growth Sitka spruce, and protect existing stands along the coast. Stands on these sites should not be thinned or harvested, and all downed logs should be left in place. It is important to preserve shade, moist conditions, and loading of woody debris in the understory. Inventories needed throughout range to better determine distribution and habitat requirements.
- D. **Benefits.** Protection of coastal spruce habitat will help offset losses on non-federal lands. Additional inventories will identify areas needing protection in Washington Cascades and Olympics, where current distribution is unknown. Protection of existing populations will enable dispersal to developing late-successional or old-growth stands elsewhere in the landscape.
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- I. **Species.** Liverwort (*Douinia ovata*) (One of two species in Canopy Interior group)
- II. **FEMAT Rating.** 73-27-0-0
- III. **Modifications due to changes in Alternative 9.** None.
- IV. **Explanation of Rating.**
- A. **Natural History.** This species occurs in both coniferous canopy and on rock outcrops and ridges, all subject to fog interception. In the canopy, it occurs on the underside of limbs, below mats of *Antitrichia curtipendula*, and also on branches in the outer canopy.
- B. **Past Actions.** Roading and logging on stream terraces has reduced occurrences and fragmented some populations on federal land. Some losses have occurred on rock outcrops quarried for gravel. Large areas of former habitat have been lost on non-federal land.

C. Species Range. Throughout region. Europe, western North America, Japan.

D. Non-habitat Factors. This species occurs in habitats subject to interception of aerosols. Air pollution will probably decimate some populations at the edge of interior valleys, as well as on stream terraces within federal lands. Liverworts are especially sensitive to air pollution, but it is not known if this species has been documented to be in decline.

E. Inadequate Information. Additional inventories needed. Abundance within region is imperfectly known.

F. Features of the Alternative. Riparian buffers were thought to have been adequate to protect many occurrences of this species, but buffer widths may be inadequate to protect larger occurrences on broad floodplains and stream terraces.

- V. Cumulative Effects Assessment.** Probably 90-95 percent of remaining populations of this species occur on federal land. Despite projected adequate protection on federal lands, large areas of former habitat have been lost on non-federal land. Deleterious effects of air pollution may cause decline in populations.
- VI. Summary.** Thought to be a fairly common species. Major threat are projected losses due to air pollution
- VII. Mitigation.** Mitigation would stabilize existing populations on federal land, although nothing can be done about air pollution originating from non-federal lands.

A. Geographic extent. Throughout region.

B. Specific habitats. Riparian buffers, stream terraces, rock outcrops with fog interception.

C. Mitigation measures. Riparian buffers should be extended to encompass entire stream terraces, as much of the biomass of this species exists beyond one or two tree lengths from streams. Because so many floodplain acres have been lost to roads, no new roads should be constructed on them. Stands on these sites should not be thinned or harvested. Also, outcrop habitats with fog interception should be left undeveloped. Damaging activities would include quarrying, road construction, siting of communication facilities and heavy hiking activity.

D. Benefits. Mitigation will stabilize populations on federal lands at existing levels, while populations on non-federal land will continue to decline. Not much can be done to offset effects of air pollution originating from non-federal land. Protection of existing populations will enable dispersal to developing late-successional or old-growth stands elsewhere in the landscape.

I. Species. Liverwort (*Kurzia makinoana*)

II. FEMAT Rating. 91-3-3-3

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating.

A. Natural History. On well-shaded rotten wood and humic soil at low elevation, especially on stream terraces and other cool, moist forest locations. Associated with wetlands in California, and old-growth in Oregon and Washington.

B. Past Actions. This species would have been completely decimated in low-elevation forests on non-federal land, due to logging and land clearing. Past losses on federal land would have occurred due to road building, thinning and harvest activities on stream terraces.

C. Species Range. Throughout region, but uncommon. North to Alaska, Asia.

D. Non-habitat Factors. Acid precipitation might be a factor, although plants might be buffered by forest canopy. Their location on the ground would be somewhat remote from areas of deposition (e.g., twigs and branches in canopy).

E. Inadequate Information. Very little is known about the abundance, distribution and ecology of this species in the region. Inventories are needed.

F. Features of the Alternative. Riparian buffers were thought to have been adequate to protect many occurrences of this species, but buffer widths may be inadequate to protect larger occurrences on broad floodplains and stream terraces.

V. Cumulative Effects Assessment. Reduction or extirpation on non-federal land at low elevation raises the importance of remaining populations on federal land.

VI. Summary. An uncommon and poorly-known species. Shifts from wetlands in south of range to old-growth in north. Preference for low-elevation sites infers large losses from past actions.

VII. Mitigation. Would certainly improve viability for remaining populations on federal land.

A. Geographic extent. Throughout range.

B. Specific habitats. Stream terraces and floodplains at low elevations, wetlands in California.

C. Mitigation measures. Riparian buffers should be extended to encompass entire stream terraces, as much of the biomass of this species probably exists beyond one or two tree lengths from streams. Because so many floodplain acres have been lost to roads, no new roads should be constructed on them. Stands on these sites should not be thinned or harvested, and all downed logs should be left in place. It is important to preserve shade, moist conditions, and loading of woody debris in the understory.

D. Benefits. Mitigation will stabilize populations on federal lands at existing levels, while populations on non-federal land are not anticipated to recover. Mitigation could not prevent losses from air pollution. Protection of existing populations will enable dispersal to developing late-successional or old-growth stands elsewhere in the landscape.

I. Species. *Marsupella emarginata* var. *aquatica* [Liverwort]

II. FEMAT Rating. 0-30-60-10

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating.

A. Natural History. This semi-aquatic species grows on rocks in the splash zone of a stream at middle to higher elevation.

B. Past Actions. Not known.

C. Species Range. Known only from one location in western North America, on stream draining Waldo Lake, western Oregon Cascades. Also known from eastern North America and Europe.

D. Non-habitat Factors. Improved recreational access to Waldo Lake between 1950 and 1975 caused a decline in the lake's water quality. Its ultraoligotrophic water had the clarity and purity of distilled water, measures which have deteriorated in recent studies. This may have adversely affected the species. Also, increasing hiker impacts around lake and along streams could threaten the species. Construction of a new footbridge at a trail crossing could unwittingly destroy one of the known populations.

E. Inadequate Information. Inventories and monitoring needed to determine distribution and abundance.

F. Features of the Alternative. Riparian zone buffers and stream protection would provide protection, but recreational activity on and around Waldo Lake could compromise the benefits of the alternative.

V. Cumulative Effects Assessment. No known populations on non-federal land in our region.

VI. Summary. A rare species, known from only one population in western North America. Would be protected in riparian and stream buffers, but is threatened by recreational pressure.

VII. Mitigation. Mitigation would address the question of whether recreational activity is having deleterious effect on species, and would improve the ratings.

A. Geographic extent. Western Oregon Cascades; to be sought in Washington Cascades.

B. Specific habitats. Streamside rocks, in splash zone, at middle to higher elevations.

C. Mitigation measures. Protect the world-class water quality of Waldo Lake. Close the lake to motorized boats, improve sewage disposal at campgrounds, and monitor water quality on a regular basis. Protect the population at the trail crossing by moderating use or rerouting the trail to protect the site. More inventories are needed to locate additional populations in more remote locations, to avoid recreational conflicts.

D. Benefits. Although little is known about this species, mitigation at existing site, and additional inventory will vastly improve its chances of viability. Protection of existing populations would also improve the chances for dispersal downstream or to other drainages.

I. Species. *Ptilidium californicum* [Liverwort]

II. FEMAT Rating. 100-0-0-0 [California only]

III. Modifications due to changes in Alternative 9. Yes -- deletion of 180-year rotation on California National Forests.

IV. Explanation of Rating.

A. Natural History. Grows on conifer bark and logs, requiring cool, moist conditions. In northern California, exhibits a strong affinity for old-growth white fir forests around 5000 feet elevation. Abundant where it occurs.

B. Past Actions. Logging (past and ongoing) at these elevations has decimated populations.

C. Species Range. Throughout region, but becomes rare in northern California. California populations are most abundant on Hoopa Indian Reservation. Endemic to Pacific Northwest.

D. Non-habitat Factors. Air pollution is always a potential problem for liverworts.

E. Inadequate Information. Occurrences on federal vs. non-federal lands should be documented to determine how much can be protected.

F. Features of the Alternative. Original plan to implement 180-year rotation would have been adequate to ensure survival of this species in this part of its range. Post-FEMAT changes to Alternative 9 call for shorter rotations, based on local forest plans. This could result in significant losses for this species.

V. Cumulative Effects Assessment. The species is most common on Hoopa Indian Reservation, where harvest of old-growth white fir is diminishing the range of the species in northern

California. Activity on non-federal land will certainly elevate status of this species on federal land.

VI. **Summary.** Common in the region except for northern California. Post-FEMAT changes put this species at risk in that part of its range where it is most restricted.

VII. **Mitigation.** Mitigation would stabilize the populations and ensure their viability.

A. **Geographic extent.** Northern California only.

B. **Specific habitats.** Old-growth white fir forests around 5000 feet elevation, lower and midslope. Bark on living boles and fallen logs.

C. **Mitigation measures.** Maintain long rotations, 180-years or more, in stands where species is present. Do not remove fallen trees and logs, as these serve as substrate in addition to bark on living trees. Amount of stands to be protected must be based on inventory for this species, to determine how much is present and how it is distributed in northern California.

D. **Benefits.** Extensive losses on non-federal lands may compromise effectiveness of mitigation on federal lands. This would depend on how many populations occur on federal land. Protection of existing populations will enable dispersal to developing late-successional or old-growth stands elsewhere in the landscape.

I. **Species.** *Scouleria marginata* [Moss]

II. **FEMAT Rating.** 100-0-0-0

III. **Modifications due to changes in Alternative 9.** None.

IV. **Explanation of Rating.**

A. **Natural History.** Grows on rocks in splash zones of streams, usually mixed with more common *Scouleria aquatica*, just above level of mean summer flows. Subject to inundation in winter, it needs clean water and cool temperatures.

B. **Past Actions.** Populations are thought to have been impacted from removal of riparian forest, increased water temperatures and silt loads from logging.

C. **Species Range.** Throughout range, but infrequent. Endemic to Pacific Northwest.

D. **Non-habitat Factors.** Increased water temperature and sediment loads from upstream logging and roads are a threat. Although the species is an efficient sediment trapper, it cannot tolerate excessive siltation.

E. Inadequate Information. Abundance and distribution poorly known, additional inventories needed.

F. Features of the Alternative. Original ratings reflected confidence that riparian buffers and watershed protection would be adequate. Concern here arises from cumulative effects on non-federal land.

- V. Cumulative Effects Assessment.** A lack of knowledge concerning the abundance and distribution of this species, the ongoing effects from harvest and roading on non-federal land, and declining regional water quality, contribute to concern about future viability due to cumulative effects. Losses on non-federal land may raise importance of this species on federal land.
- VI. Summary.** Distribution and abundance of this aquatic species is uncertain. Ongoing activities on non-federal land that degrade water quality will increase importance of populations on federal land.
- VII. Mitigation.** Mitigation would stabilize populations on federal land, unless non-federal land is upstream.
- A. Geographic extent.** Throughout range.
- B. Specific habitats.** Rocks in splash zones of streams, low to higher elevations.
- C. Mitigation measures.** Maintain riparian buffers and other watershed protection measures as prescribed in alternative. No new road construction. Additional inventory will determine if recreational uses impact populations.
- D. Benefits.** Mitigation would stabilize existing populations on federal land, and would help improve water quality for non-federal lands downstream. Activities on non-federal land upstream could compromise effectiveness of mitigation. Protection of known populations would improve chances of dispersal downstream, and into different drainages.

I. Species. *Thamnobryum neckeroides* [Moss]

II. FEMAT Rating. 60-20-20-0

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating..

A. Natural History. Grows on densely shaded, moist organic soil and rocks in thickets of willow, vine maple and Sitka alder, at middle to higher elevations. Thickets usually occur at

the margins of avalanche tracks, seepage areas, and the bases of talus slopes in headwall areas, confluent with stands of old-growth. Sites often have late-lying snow beds.

B. Past Actions. Road building below headwalls, and logging has probably decimated some populations, especially on non-federal land.

C. Species Range. Distribution of this species is sporadic, unpredictable and may always have been patchy. Known primarily from the western Cascades, Oregon to Alaska. Endemic to Pacific Northwest.

D. Non-habitat Factors. Acid precipitation, concentrated in snow beds, could alter water chemistry in these habitats and impact the species.

E. Inadequate Information. Additional inventories needed to determine abundance and distribution.

F. Features of the Alternative. It would probably receive adequate protection in riparian prescriptions and headwall buffers.

V. Cumulative Effects Assessment. Difficult to assess, because of lack of data. Some losses have no doubt occurred on federal and non-federal land, shrinking the range of this species in our area.

VI. Summary. Spotty distribution of this species makes it difficult to assess losses and cumulative effects.

VII. Mitigation. Mitigation will help stabilize populations of this species on federal lands.

A. Geographic extent. Mostly western Cascades.

B. Specific habitats. Thickets of willow, vine maple and Sitka alder at middle to higher elevations, occurring at margins of avalanche tracks, seepage areas and bases of talus slopes, especially in headwall areas.

C. Mitigation measures. Keep roads and heavy equipment out of these habitats. Do not thin or harvest in adjacent old-growth stands, as this could alter hydrology and microclimate.

D. Benefits. Headwall buffers and riparian protection would stabilize the species on federal land. Not much can be done about occurrences on non-federal land, nor about putative effects of acid precipitation concentrated in snow beds. Although this species produces spores only rarely, protection of known populations would improve chances of dispersal to other sites.

- I. **Species.** *Tritomaria exsectiformis* [Liverwort]
- II. **FEMAT Rating.** 0-30-40-30
- III. **Modifications due to changes in Alternative 9.** None.
- IV. **Explanation of Rating.**
 - A. **Natural History.** Occurs on shaded moist soil or rocks from low to high elevation, especially around spring heads. In Oregon, it is known primarily from riparian areas subject to considerable trampling by recreationists.
 - B. **Past Actions.** Trampling by recreationists and livestock in riparian areas may have caused declines.
 - C. **Species Range.** West and east slope of Cascades, Olympic Mountains and northward. Circumboreal.
 - D. **Non-habitat Factors.** Acid precipitation may pose threats.
 - E. **Inadequate Information.** Additional inventory needed for this species to determine abundance and distribution.
 - F. **Features of the Alternative.** In theory, riparian buffers should be adequate to protect this species, but the heavy recreational trampling in the known localities would compromise effectiveness of treatment.
- V. **Cumulative Effects Assessment.** Probably 90-95 percent of populations are on federal land, given the habitat needs for this species.
- VI. **Summary.** Sporadic distribution in riparian areas, and lack of adequate inventory data, make this species difficult to protect. Concentration of recreational use at known localities calls for mitigation beyond what is supported by the alternative.
- VII. **Mitigation.** Mitigation would certainly improve ratings for this species.
 - A. **Geographic extent.** Cascades.
 - B. **Specific habitats.** Shaded moist soil and rocks in riparian areas by spring heads.
 - C. **Mitigation measures.** In addition to riparian buffers, fences are needed to keep recreationists and livestock out of the spring head areas and associated marshes, where trampling has the most impact.
 - D. **Benefits.** Fencing will keep many casual visitors out of critical areas, and will markedly improve ratings for this species. Protection of existing populations will allow dispersal downstream and into other drainages, where new populations may become established.

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Bondarzew's Polypore

Bondarzewia montana	J2-186
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Rare Resupinates and Polypores

Aleurodiscus farlowii	J2-188
Dichostereum granulatum	J2-188
Grandinia microsporella	J2-188
Phlebia diffusa	J2-188
Polyporoletus sublividus	J2-188
Postia rennyi	J2-188

Scytinostroma cf. galatinum J2-188

Uncommon Cup Fungi

Cudonia circinans J2-189
Cudonia monticola J2-189
Gyromitra californica J2-191
Gyromitra esculenta J2-191
Gyromitra infula J2-191
Gyromitra melaleucoides J2-191
Gyromitra montana (syn. G. gigas) J2-191
Otidea leporina J2-192
Otidea onotica J2-192
Otidea smithii J2-192
Plectania melastoma J2-193
Podostroma alutaceum J2-194
Sarcosphaera eximia J2-195
Sarcosoma mexicana J2-196
Spathularia flavida J2-189

Rare Cup Fungi

Aleuria rhenana J2-197
Bryoglossum gracile J2-198
Gelatinodiscus flavidus J2-200
Helvella compressa J2-201
Helvella crassitunicata J2-201
Helvella elastica J2-201
Helvella maculata J2-201
Neourula pouchetii J2-202
Pithya vulgaris J2-203
Plectania latahensis J2-204
Plectania milleri J2-205
Pseudaleuria quinaultiana J2-207

Jelly Mushroom

Phlogiotis helvelloides J2-208

Branched Coral Fungi

Clavulina cinerea J2-209
Clavulina cristata J2-209
Clavulina ornatipes J2-209

Parasitic Fungi

Cauliflower Mushroom

Sparassis crispa J2-210

Parasitic Fungi

Asterophora lycoperdoides J2-212
Asterophora parasitica J2-212

Collybia racemosa	J2-212
Cordyceps capitata	J2-212
Cordyceps ophioglossoides	J2-212
Hypomyces luteovirens	J2-212

Other

Club Coral Fungi

Clavariadelphus ligula	J2-214
Clavariadelphus pistillaris	J2-214
Clavariadelphus truncatus	J2-214
Clavariadelphus borealis	J2-214
Clavariadelphus lovejoyae	J2-214
Clavariadelphus sachalinensis	J2-214
Clavariadelphus subfastigiatus	J2-214

Moss dwelling mushrooms

Cyphellostereum laeve	
Galerina atkinsoniana	J2-216
Galerina cerina	J2-216
Galerina heterocystis	J2-216
Galerina sphagnicola	J2-216
Galerina vittaeformis	J2-216
Rickenella setipes	J2-216

Mushroom Lichen

Phytoconis ericetorum	J2-217
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Coral Fungus

Clavicornia avellanea	J2-219
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- I. **Species.** Bolete (*Gastroboletus subalpinus*)
- II. **FEMAT Rating.** 70-30-0-0
 (collective rating for Bolete group)
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. Natural History.** Endemic to Oregon Cascades and northern Sierras in California, probably ectomycorrhizal with lodgepole pine and whitebark pine, and possibly other Pinaceae at elevations from 4,500 ft. to timberline.
- B. Past Actions.**
- C. Species Range.** Type locality is its northernmost record, Cloud Cap, Mt. Hood, Mt. Hood National Forest, Oregon. The range extends southward to the northern Sierras; locally abundant, but the places of abundance are greatly disjunct and often in areas of high recreational use.
- D. Non-habitat Factors.** Species may be impacted by recreational use, camping, trampling and soil compaction (most known localities are in campgrounds).
- E. Inadequate Information.** Occurrence between disjunctions of known local abundance is unknown.
- F. Features of the Alternatives.**
- V. **Cumulative Effects Assessment.** Because of elevational range, most populations are likely on federal land.
- VI. **Summary.** Species is locally endemic and known from no more than 8 collections, although these span the Oregon Cascades to the northern Sierras.
- VII. **Mitigation.** Presumably more common than now recognized; protection of habitat in representative localities of local abundance would lessen risk of serious depletion of populations pending better information on distribution.
- A. Geographic Extent.** Type locality at Cloud Cap, Mt. Hood, Mt. Hood National Forest, extending from there south to northern Sierras of California.
- B. Specific Habitats.** Oregon - Cloud Cap, Mt. Hood, and Hood View Forest Camp, Timothy Lake, Mt. Hood National Forest; Elk Lake, Deschutes National Forest; 2 miles E. of Cascade Pass, Winema National Forest; Goodby Campground, Crater Lake National Park.

C. Mitigation Measures. Preserve at least one area of low recreational impact; the best candidate at present is 2 miles E. of Cascade Pass, Oregon along State Highway 138 in a lodgepole pine stand on the north side of the highway. This area would preserve a large population of the species if protected from fire and timber harvest pending survey of adjacent Crater Lake National Park lands for the species. If it proves abundant in the National Park, the proposed preserved area could be opened to other uses. Survey to delineate boundaries of known populations, establish buffer around known locations to provide for adequate protection of population. Establish Mycological Special Interest Area to protect type locality. Survey suitable habitat to find additional populations. Monitor populations for recreation impacts. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Preservation of a locally abundant population free of heavy recreational use would minimize the chances of serious depletion of this endemic species through trampling, soil compaction, etc.

I. Species.

False Truffle (*Thaxterogaster pingue*)
Bolete (*Gastroboletus turbinatus*)

II. FEMAT Rating.

55-25-20-0 (*Thaxterogaster pingue*, collective rating for False Truffle group)
70-30-0-0 (*Gastroboletus turbinatus*, collective rating for Bolete group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. These widely distributed fungi occur in mature to old-growth forests in a wide variety of habitats as ectomycorrhizal associates: *Gastroboletus turbinatus* with true firs, Engelmann and Sitka spruce, mountain and western hemlocks from coastal forests to relatively high elevations; *Thaxterogaster pingue* with true firs only at mid- to high elevations. The habitats are generally characterized by relatively thick humus development and an abundance of large, coarse woody debris.

B. Past Actions.

C. Species Range. *Gastroboletus turbinatus*: North Cascades of Washington south to the northern Sierras; Washington Coast; Oregon Coast and Coast Ranges and Siskiyou Mountains; Klamath Mountains of California; northern Idaho; Missouri; Mexico.

Thaxterogaster pingue: Cascade Mountains from Canadian Border to northern

Sierras of California; northern Rocky Mountains; Siskiyou Mountains of Oregon south to Klamath Mountains of California.

D. Non-habitat Factors. The coastal localities of *Gastroboletus turbinatus* are in areas of heavy recreational use, potentially subject to trampling and soil compaction. Siskiyou and Klamath Mountain localities of both species have a history of extensive logging.

E. Inadequate Information.

F. Features of the Alternative. Marbled murrelet zones may protect suitable habitats for coastal representatives of *Gastroboletus turbinatus*.

V. Cumulative Effects Assessment. Most known high elevation localities for these species are already preserved in wilderness or botanic areas on federal lands.

VI. Summary. These unusual but common and widely distributed species occupy mature to old-growth forests or forests with an abundant legacy of coarse woody debris and humus development. Because of their wide range and present protection of habitats in wilderness or botanic areas and National Parks, risk of extirpation is not anticipated.

VII. Mitigation. Continue preservation of habitat as already accomplished in designated wilderness and botanic areas and National Parks. Protect the type locality of *Thaxterogaster pingue*.

A. Geographic Extent. (see Species Range).

B. Specific Habitats. Locally abundant throughout the geographic extent. The type locality of *Thaxterogaster pingue* is Horse Camp, Mt. Shasta National Recreation Area.

C. Mitigation Measures. Continue preservation of habitat as already accomplished in designated wilderness and botanic areas and National Parks. Initiate process of establishing a Mycological Special Interest Area for the type locality of *Thaxterogaster pingue* at Mt. Shasta National Recreation Area.

D. Benefits. Continued preservation of suitable habitats will eliminate risk of extirpation.

I. Species Group. Low Elevation Boletes (*Boletus piperatus*, *Tylopilus pseudoscaber*)

II. FEMAT Rating. 17-43-40-0
(collective rating for Low Elevation Bolete group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. *Tylopilus pseudoscaber*, a Pacific Northwest endemic, occurs in low elevation moist habitats, often associated with Sitka spruce forests. *Boletus piperatus* occurs in low to mid elevation forests. Both species are mycorrhizal and require coarse woody debris in decay class III, IV, V.

B. Past Actions. Loss of low elevation old-growth and coastal Sitka spruce forests has contributed to loss of habitat for these species, and potential isolation of populations.

C. Species Range.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Location of specific reserves and distribution of the reserves across the landscape were important in species rating.

V. Cumulative Effects Assessment. Since these species occur in low elevation forests, what little habitat remains on state and private land is important for their viability.

VI. Summary. Ratings reflect species distribution and association with low elevation and coastal Sitka spruce forests. Much of this area is in younger age classes, and non-federal ownership, so actual habitat is limited.

VII. Mitigation. Mitigation could improve ratings by providing for low elevation old-growth habitat, well-distributed throughout the coastal and low elevation areas.

A. Geographic Extent. Throughout range of northern spotted owl.

B. Specific Habitats. Low elevation and coastal Sitka spruce forests

C. Mitigation Measures. Maintain existing low elevation and coastal Sitka spruce old-growth stands. Identify areas where low elevation stands are limited and manage to allow additional stands to mature into old-growth to provide a network of habitat for these fungi. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, and maintain significant amounts of coarse woody debris in decay classes III, IV, and V which are required by these species; aggregate leave trees, and minimize site disturbance. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations.

D. Benefits. Protection of existing low elevation and coastal Sitka spruce old-growth forests, along with managing for additional stands to achieve old-growth condition should improve viability ratings for these two species.

I. Species Group. Rare Boletes (*Boletus haematinus*, *Boletus pulcherrimus*)

II. FEMAT Rating. 2-52-28-18
(collective rating for Rare Bolete group)

III. Modifications due to changes in Alternative 9. Since *Boletus haematinus* is associated with high elevation silver fir forests, and ranges into California, the removal of the 180-year rotation in the matrix lands of California may reduce suitable and potential habitat; this species has never been observed in forests that have been disturbed.

IV. Explanation of Rating

A. Natural History. These species are rare, but widely and sporadically distributed, and endemic to the Pacific Northwest. *Boletus haematinus* occurs in high montane conifer forests associated with *Abies*. *Boletus pulcherrimus* is found in low to mid elevation conifer forests, is relatively rare, and often occurs as single or a few fruiting bodies.

B. Past Actions. Logging of low elevation forests may have removed habitat for *Boletus pulcherrimus*. Management in high elevation *Abies* forests in California may have removed habitat for *Boletus haematinus*.

C. Species Range. *Boletus haematinus* occurs from California north to (?)Stevens Pass, Washington; *Boletus pulcherrimus* ranges from California into Canada, and Olympics.

D. Non-habitat Factors

E. Inadequate Information. Specific sites of species occurrences are not well known.

F. Features of the Alternative.

V. Cumulative Effects Assessment. *Boletus pulcherrimus* is a low elevation old-growth species, so what little old-growth habitat remains on state and private land may be important for its viability. *Boletus haematinus* needs mature *Abies* forests, checkerboard ownership of private lands in California may be important for this species viability.

VI. Summary. Rating reflects rare and sporadic distribution across the landscape, loss of low elevation old-growth forests and mature *Abies* forests in California.

VII. Mitigation. Mitigation could improve ratings for localities which occur outside of late-successional reserves.

A. Geographic Extent. Range of northern spotted owl

B. Specific Habitats. Low to mid elevation old-growth forests; high elevation *Abies* forests in California.

C. Mitigation Measures. Identify and protect specific sites where these species occur. Protect and buffer type localities. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix land allocations. Conduct surveys to find new locations as part of watershed analysis. Site locations should be documented and maintained in a regional Geographic Information System, so land managers will know where populations exist before planning or executing projects. Manage to maintain low elevation conifer forests, and high elevation *Abies* forests in California, that are well-distributed across the landscape. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Protection of known locations and managing for old-growth stands within areas where species are suspected to occur should reduce risk of extirpation.

I. Species Group.

Rare Gilled Mushrooms, Ectomycorrhizal (*Chroogomphus loculatus*)

Rare Boletus (*Gastroboletus imbellus*)

Rare Undescribed Taxa -

(*Martellia* sp. nov. # Trappe 1700)

(*Octavianina* sp. nov. # Trappe 7502)

(*Rhizopogon* sp. nov. # Trappe 1692)

(*Rhizopogon* sp. nov. # Trappe 1698)

(the two Undescribed *Rhizopogon* spp. were added after publication of FEMAT)

II. FEMAT Rating.

5-50-28-18 (collective rating for Rare Gilled Mushrooms, group - Ectomycorrhizal)

0-2-83-15 (collective rating for Rare Boletus/False Truffle group)

0-0-60-40 (collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species are very rare and locally endemic. These species are

probably all ectomycorrhizal with Pinaceae.

B. Past Actions. The type localities are all within the Lamb Butte Scenic Area.

C. Species Range. All species in this group are known only from type collections from the Willamette National Forest along the Olallie trail to The Potholes (Lamb Butte Scenic Area, T 17 S., R 6 E., Secs. 15, 22 and 27).

D. Non-habitat Factors

E. Inadequate Information. The species in this group have not been seen in at least 4 collecting trips to the Lamb Butte Scenic Area since the types were collected, and they have not been found elsewhere.

F. Features of the Alternatives. Other than designation of scenic area status of Lamb Butte, protection of these type localities has not been provided.

V. Cumulative Effects Assessment. The distribution of these species outside the Lamb Butte Scenic area is unknown, although it is likely that all occur in similar habitats nearby, e.g. the Olallie Ridge Research Natural area to the north of Lamb Butte.

VI. Summary. These species are all rare and known only from the type locality. Species that are very rare and locally endemic were not rated higher than C in the original rating. This rating is more reflective of species natural history and rarity rather than features of the alternatives. For either habitat or habitat history, this area concentrates an unusual number of rare fungal species. These species may not be solely restricted in distribution because of what we do with management activities but may be influenced by inherent life history characteristics, habitat requirements, distribution of particular habitat, and the history of the habitat in which they occur.

VII. Mitigation. Mitigation for protection and buffering of type locations could reduce risk of extirpation and improve viability of species at these known locations.

A. Geographic extent. All species in this group are known only from type collections from the Willamette National Forest along the Olallie trail to The Potholes (Lamb Butte Scenic Area, T 17 S., R 6 E., Secs. 15, 22 and 27).

B. Specific Habitats. Upper mid-elevation (ca. 5,000 ft.) stands of mature to old *Abies grandis*, *Abies amabilis*, *Pseudotsuga menziesii*, *Tsuga heterophylla*, and *Tsuga mertensiana*.

C. Mitigation Measures. Protect and buffer type localities by expansion of the Lamb Butte Scenic Area to merge with the Olallie Ridge Research Natural Area and to extend the boundaries of the protected areas to encompass the entire ridge system at least to McLennan Mtn. and downslope to adjacent roads on the west and south slopes and to elevations of ca. 3,500 ft. on the north and east slopes. Survey for repeat occurrences of these species over different seasons and in similar habitats in the McKenzie River drainage should be done as part of watershed analysis.

Because the area appears to harbor these rare species, still other rare species can be expected to be found. Designation as a Mycological Special Interest Area would provide better emphasize the area's values. Site locations and distribution of these species should be documented and maintained in a regional Geographic Information System, so land managers will know where populations exist before planning or executing projects. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of known locations and expanding the area to include nearby, similar, habitats will lessen the risk of extirpation of these rare endemics. Designation of a Mycological Special Interest Area for these species will also benefit a number of other rare or endemic species which also occur here.

I. Species. Rare Bolete (*Gastroboletus ruber*)

II. FEMAT Rating. 67-22-8-3

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Closely associated with old-growth mountain hemlock as an ectomycorrhizal fungus. This rare endemic is found at upper mid- to high elevations in mature to old-growth forests with a well-developed humus layer. Known from 16 collections.

B. Past Actions.

C. Species Range. North Cascades of Washington south to Willamette Pass, Oregon. Type locality is "near Snoqualmie Pass, Washington."

D. Non-habitat Factors. Most known localities are in already protected areas (wilderness areas, national parks), although some are in heavily used recreational areas. The type locality experiences particularly intense recreational use.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. With the possible exception of the type locality "near Snoqualmie Pass" in Washington, all known localities are on federal land.

VI. Summary. Host-specific to mountain hemlock, so availability of host species is important to survival. Most areas where fungus is known to occur are not managed for timber harvest, except possibly Willamette Pass.

VII. Mitigation. Continue preservation of localities now in wilderness or national park status. Attempt to relocate the type locality and, if found, provide protection with designation of Mycological Special Interest Area.

A. Geographic Extent. North Cascades of Washington south to Willamette Pass, Oregon.

B. Specific Habitats. Type locality: "near Snoqualmie Pass," Washington. Other Washington locations - 4 miles N. of Copper Lake, upper Chilliwack River, and Cascade Pass trailhead, North Cascades National Park; Lyman Lake, Glacier Peak Wilderness Area, Wenatchee National Forest; Tombstone Lake, Gifford Pinchot National Forest. Oregon - Tilly Jane Forest Camp, Mt. Hood National Forest; Cabot, Carl and Shirley Lakes, Mt. Jefferson Wilderness Area, Deschutes National Forest; Lamb Butte Scenic Area and Willamette Pass, Willamette National Forest.

C. Mitigation Measures. Continue preservation of localities now in wilderness or national park status. Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Monitor for recreation impacts. Attempt relocation of type locality and, if found, inventory for populations and establish Mycological Special Interest Area to protect type locality. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the type locality and continued protection of other known localities will minimize risk of extirpation.

I. Species. False Truffle (*Nivatogastrium nubigenum*)

II. FEMAT Rating. 55-25-20-0
(collective rating for False Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. An inhabitant of brown-cubical-rotted coarse woody debris on xeric sites at mid to high elevations, in mature to old-growth forests or stands with an abundant legacy of large coarse woody debris. This species appears to be one of the few hypogeous to subhypogeous decomposers that relies on being eaten by mammals for its spore dispersal.

B. Past Actions.

C. Species Range. Cascade Mountains of California north to Mt. Adams, Washington; northern Idaho.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Retention of large, coarse woody debris is required to maintain habitat for the species.

V. Cumulative Effects Assessment. All known localities are on federal land.

VI. Summary. Advance-decayed, coarse woody debris characterizes the habitat for this unusual fungus.

VII. Mitigation. Maintain abundant coarse woody debris in habitats occupied by this species.

A. Geographic Extent. (see Species Range)

B. Specific Habitats. California - Mt. Lassen and Mt. Shasta. Oregon - Crater Lake National Park; Three Creeks Lake, Deschutes National Forest. Washington - Mirror Lake, Mt. Adams, Gifford Pinchot National Forest.

C. Mitigation Measures. Maintain abundant coarse woody debris in habitats occupied by this species. Within harvest areas in the matrix, aggregate leave trees to provide adequate interior microclimate and duff layer, minimize site disturbance.

D. Benefits. Provision of abundant, advance-decayed coarse woody debris as substrate for this fungus will minimize risk of extirpation.

-
- I. Species.** False Truffles
(*Rhizopogon abietis*)
(*Rhizopogon atroviolaceus*)
(*Rhizopogon truncatus*)

II. FEMAT Rating. 55-25-20-0* (collective rating for False Truffle group)

[*Note: *Rhizopogon abietis* and *Rhizopogon atroviolaceus* were originally in Rare False Truffle group, but have been reassigned to False Truffle group, based on additional information not

available at the time of the original rating.]

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. These species occur in stands of mixed conifers, including Douglas-fir, yellow and white pines, true firs, and mountain hemlock, in moderate to dry sites at relatively high elevations.

B. Past Actions.

C. Species Range. *Rhizopogon abietis*: eastern Canada, eastern United States, northern Rocky Mountains, Strawberry Range of eastern Oregon, and Cascade and Klamath Mountains of Oregon and California. *Rhizopogon atroviolaceus*: Idaho; northern Cascade Range of Oregon. *Rhizopogon truncatus*: northeastern United States, Klamath and Cascade Mountains of California and Oregon.

D. Non-habitat Factors. Some localities of both species are in designated wilderness or recreational areas; other localities are in areas with a history of extensive logging or intensive recreational use.

E. Inadequate Information. Known from widely scattered but only a few localities in the range of the northern spotted owl.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Most known localities of these fungi are on federal land, although some localities are on private land in the Klamath Mountains of northern California (*Rhizopogon abietis*). Each species is represented in designated wilderness areas.

VI. Summary. Rating of these widely distributed but infrequent fungi reflects their natural history more than features of the alternatives; elimination of the 180-year rotation in California may deplete their habitat there.

VII. Mitigation. Initiate process of establishing a Mycological Special Interest Area at Deadfall Meadows, Klamath National Forest. Continue protection of other localities in wilderness areas.

A. Geographic Extent. (see Species Range)

B. Specific Habitats. *Rhizopogon abietis*: Breitenbush and Waldo Lakes, Willamette National Forest; Siskiyou Mountains, along Oregon-California border (private land); Deadfall Meadows, Klamath National Forest. *Rhizopogon truncatus*: H.J. Andrews Experimental Forest and Waldo Lake, Willamette National Forest; Yoran Lake, Diamond Peak Wilderness Area, Deschutes National Forest; Limpy Rock Research Natural Area, Umpqua National Forest; Union Creek and Wrangle Campground, Rogue River National Forest; Mt. Lassen National Park. *Rhizopogon atroviolaceus*:

Cascades in northern Oregon.

C. Mitigation Measures. Initiate process of establishing a Mycological Special Interest Area at Deadfall Meadows, Klamath National Forest; inventory populations and maintain protection of other localities in established wilderness and recreational areas. Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of these species.

D. Benefits. Protection of habitats in known localities will reduce risk of extirpation of these infrequent species.

I. Species.

Uncommon False Truffle (*Macowanites chlorinosmus*)
Rare Zygomycete (*Endogone oregonensis*)

II. FEMAT Rating.

20-30-40-10 (collective rating for Uncommon False Truffle group)
0-18-60-23 (collective rating for Rare Zygomycete group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. These rare, local endemics are confined to the Oregon coast and Coast Ranges in mature to old-growth stands of Douglas-fir, Sitka spruce, and western hemlock at low elevations. Both are probably ectomycorrhizal associates of western hemlock and perhaps the other species mentioned. Both also occur in young forests with an abundant legacy of large, coarse woody debris.

B. Past Actions.

C. Species Range. *Macowanites chlorinosmus*: Tillamook County, Oregon south to Humboldt County, California; type locality-Cape Lookout State Park picnic ground. *Endogone oregonensis*: Tillamook County south to Douglas County and east to Benton County, Oregon; type locality - Green Point, Cascade Head, Siuslaw National Forest.

D. Non-habitat Factors. Known localities are in areas of extensive logging that removed appropriate habitat and hosts, or of current heavy recreational use that may result in trampling and soil compaction.

E. Inadequate Information. Habitats in which these species occur have been intensively surveyed only in a few localities. Intervening areas are poorly known.

F. Features of the Alternative. Some locations may be in marbled murrelet zone.

V. Cumulative Effects Assessment. Known localities are partly on federal land (Siuslaw National Forest), partly on Oregon State Park, Oregon State Highway, Oregon State University McDonald Forest and private lands.

VI. Summary. These rare, local endemics, including the type localities, are in areas with an extensive history of logging and present intensive recreational use. Their rating reflects rarity and natural history in drastically reduced habitats.

VII. Mitigation. Intensively inventory remaining habitat within the known range of the species. Protect type localities by establishment of Mycological Special Interest Areas

A. Geographic Extent. *Macowanites chlorinosmus*: Tillamook County, Oregon south to Humboldt County, California. *Endogone oregonensis*: Tillamook County south to Douglas County and east to Benton County, Oregon.

B. Specific Habitats. *Macowanites chlorinosmus*: Cape Lookout State Park, Oregon (type locality), Sitka spruce/western hemlock stand in main picnic ground north of parking lot; Cape Meares, Oregon; Boardman State Park, Whalehead Wayside, Oregon; Neptune State Park, Oregon; Cascade Head, Siuslaw National Forest, T 6 S., R 10 W., Sec. 16, SE 1/4; Camp Meriweather (Boy Scouts of America), Oregon; Prairie Creek State Park, Fern Canyon, California.

Endogone oregonensis: Green Point, Cascade Head Experimental Forest, Siuslaw National Forest (type locality), T 6 S., R 10 W., Sec. 22, SE 1/4; Van Duzen Corridor, State Highway 18; Valsetz, Oregon (private land); Oregon State University MacDonald Forest; Starker Forest, near Blogett (private land); Blue Ridge, near Kellogg, Oregon (private land).

C. Mitigation Measures. Intensively inventory remaining habitat within the known ranges of the species. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Negotiate with Oregon State Parks Commission for protection of type locality of *Macowanites chlorinosmus* and develop awareness of other locations on state park lands, and sensitivity of populations to development. Initiate process of establishing a Mycological Special Interest Area in the type locality of *Endogone oregonensis* at Cascade Head Experimental Forest. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Preservation of type localities and protection of localities on federal and state lands will reduce risk of extirpation of the species.

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- I. **Species.** Rare False Truffle (*Alpova alexsmithii*)
- II. **FEMAT Rating.** 0-35-50-15
 (collective rating for Rare False Truffle group)
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. Natural History.** Endemic to mature and old-growth forests of the Cascade Mountains at mid- to upper mid-elevations; probably ectomycorrhizal with mountain hemlock, true firs, and possibly other Pinaceae.
- B. Past Actions.**
- C. Species Range.** Mount Rainier National Park south to Willamette Pass, Willamette National Forest, Oregon; an outlier locality is Mount Seymour, North Vancouver, British Columbia.
- D. Non-habitat Factors.** The type locality is close to a road in a heavily used recreational area. Road widening could infringe on the population.
- E. Inadequate Information.** Known from only 7 collections from widely disjunct populations. Surveys in similar habitats between known localities are needed to further understand its distribution and ecology.
- F. Features of the Alternatives.**
- V. **Cumulative Effects Assessment.** Because of its general occurrence at relatively high elevations, other populations are most likely to be on federal land.
- VI. **Summary.** This species is rare and endemic to the Cascade Mountains and adjacent coastal mountains of British Columbia. The rating reflects its natural history and rarity more than features of the alternatives.
- VII. **Mitigation.** Continued protection of the type locality in Mount Rainier National Park and of Oregon localities should minimize risk of extirpation.
- A. Geographic Extent.** British Columbia Coast Range and Cascade Mountains from Mt. Rainier south to Willamette Pass, Oregon.
- B. Specific Habitats.** The type locality and a second collection are from near Mowich Lake, Mount Rainier National Park. Oregon localities: Still Creek Campground and Breitenbush Lake (Olallie Lake Scenic Area), Mt. Hood National

Forest; Carl Lake (Mt. Jefferson Wilderness Area), and Willamette Pass, Willamette National Forest.

C. Mitigation Measures. Protection of type locality in Mt. Rainier National Park, and additional populations in the Olallie Lake Scenic Area and Mt. Jefferson Wilderness Area; consider designation of special interest area to protect type locality and known populations. Survey to delineate boundaries of habitat and population, establish buffer around localities to provide for adequate protection of population. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Survey suitable habitat to find additional populations.

D. Benefits. The mitigation should minimize risk of extirpation.

I. Species. Rare False Truffle (*Alpova olivaceotinctus*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9. Elimination of the 180-year rotation in northern California will greatly reduce the future habitat available to this species.

IV. Explanation of Rating.

A. Natural History. Only a single collection is known from the range of the northern spotted owl in probably an ectomycorrhizal association with mature Shasta fir. This may be the northernmost outlier of the species.

B. Past Actions.

C. Species Range. On private land (Fruit Growers Supply Co.) west of Hilt, Siskiyou Mountains, Siskiyou County, California. Otherwise known from southern California mountains in association with white fir.

D. Non-habitat Factors. Extensive timber harvest around the single locality of concern may have extirpated part of the population.

E. Inadequate Information. The distribution of this species is very poorly known; mycological survey of appropriate habitats is needed.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. The single occurrence of concern is on private land,

although national forest land with similar habitat is nearby. Much of the Shasta fir habitat that may be suitable for this species has been already logged.

VI. **Summary.** This rare species has an apparent northern outlier in the southern part of the range of the northern spotted owl on private land.

VII. **Mitigation.** Survey of federal land near the known locality on private land is needed to determine if populations exist there in similar habitats that can be protected. Protection of such habitats would lessen risk of a southward reduction of the northern limits of the species.

A. **Geographic Extent.** Siskiyou Mountains of northern California; the type locality is in southern California.

B. **Specific Habitats.** Hilt Forest of Fruit Growers Supply Co., Siskiyou Mountains, Siskiyou County, west of Interstate 5 in California near the Oregon border.

C. **Mitigation Measures.** Survey federal land nearby and in similar habitats as the known locality on private land. Protect new localities with substantial buffers as found.

D. **Benefits.** Minimize the risk of extirpating the species in the northernmost limits of its range.

I. **Species Group.**

Rare False Truffles

(*Arcangeliella crassa*)

(*Arcangeliella lactarioides*)

(*Martellia fragrans*)

(*Martellia monticola*)

(*Sedecula pulvinata*)

Rare Truffles (*Choiromyces alveolatus*)

II. **FEMAT Rating.**

0-35-50-15 (collective rating for Rare False Truffle group)

0-18-60-23 (collective rating for Rare Truffle group)

III. **Modifications due to changes in Alternative 9.** Removal of the 180-year rotation in California may decrease current and potential habitat for these species.

IV. **Explanation of Rating.**

A. **Natural History.** Habitat of these species is primarily old-growth *Abies* spp. or *Tsuga mertensiana* at mid to high elevations. They are known to be or presumably

are mycorrhizal. Coarse woody debris is an important structural component of their habitat. They are hypogeous fungi that contribute to the diets of small mammals that. These species are grouped together because they share a common locus of abundance in the Mt. Shasta/Mt. Lassen region.

B. Past Actions. Cutting of montane *Abies* forests may have removed and degraded habitat for these species.

C. Species Range. As a group, their primary distribution ranges along the Cascade-Sierran axis from Mt. Hood to the Yuba Pass area, with disjunct locations in Idaho and Colorado.

Arcangeliella crassa - Infrequent in the upper montane *Abies* forests of northern California.

Arcangeliella lactarioides - Current distribution is from Mt. Shasta to Mt. Lassen

(Swain Mt. Experimental Forest). Known from only these two areas since first described in 1947.

Choiromyces alveolatus - Infrequently found in upper montane forests from Mt. Hood, Oregon to Yuba Pass, California, and west to the coast.

Martellia fragrans - Since first discovered in 1962, it is known from only 3 collections:

southern Oregon (Rogue River National Forest), northern California (Mt. Lassen National Forest) and Idaho (Payette National Forest).

Martellia monticola - Distributed from the central Oregon Cascades to the northern

Sierras, and also found on the Idaho side of Hell's Canyon. Known from only 4 locations since it was described in 1899.

Sedecula pulvinata - Four collection sites known from Mt. Shasta to Yuba Pass, California

Disjunct near Boulder, Colorado.

D. Non-habitat Factors.

E. Inadequate Information. The condition of historical locations is not known.

F. Features of the Alternative. An important factor affecting the viability of these species is the total acreage and distribution of late-successional and old-growth *Abies* forest in their core range. Quality and abundance of coarse woody debris in the forest floor is also an important factor.

V. Cumulative Effects Assessment. Incremental loss of habitat and conversion to tree plantations of unsuitable species for mycorrhizal symbiosis may have isolated populations of these species and reduced opportunities for gene flow and dispersal.

VI. Summary. Rating reflects rare and infrequent occurrence across their ranges, relatively restricted distribution of potential habitat in the landscape, and actual loss of mature and old-growth *Abies* through management practices.

VII. Mitigation. Mitigation could improve viability ratings for these species.

A. Geographic Extent. Western Oregon and northern California

B. Specific Habitats. Upper montane *Abies* forests merit particular attention but other mature and old-growth forests (those with an *Abies* component) may be locally important.

C. Mitigation Measures. Identify and protect specific sites where these species occur. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of Mycological Special Interest Area to protect type localities and known populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. A system of ecologically significant *Abies* reserves in the core range (Mt. Shasta to Mt. Lassen) would help maintain viable populations of these species and would compliment a system of aggregated retention in managed stands. Monitoring and research on the effectiveness of coarse woody debris and patch retention on the survival and dispersal of these species is essential.

D. Benefits. A system of refugia and potential remnant/dispersal habitat will increase the viability ratings for these species and reduce their risk of extirpation.

I. Species. Rare False Truffles (*Destuntzia fusca*; *Destuntzia rubra*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9. Elimination of the 180-year rotation in northern California may greatly reduce the future habitat available to these species.

IV. Explanation of Rating.

A. Natural History. *Destuntzia rubra* is known from only five collections, *Destuntzia fusca* from four collections. Both species inhabit lowland, mature forests near the coast in Mendocino County, California. Habitat is mixed forests consisting of various combinations of coastal redwood, Douglas-fir, true firs, western hemlock, oak, and tanoak. *Destuntzia rubra* has also been collected once from the northern Sierras (habitat not recorded) and a lowland forest (logged since collection) in the Cascade foothills of western Oregon. *Destuntzia fusca* has been found twice in old-growth Douglas-fir stands in the H. J. Andrews Experimental Forest, Willamette National Forest, Oregon. Both species are probably ectomycorrhizal with Pinaceae

and possibly Fagaceae. *Destuntzia fusca* is endemic to the range of the northern spotted owl, based on current knowledge.

B. Past Actions. Logging of suitable habitat or sites of known populations has removed mycorrhizal hosts and impacted populations.

C. Species Range. Santa Cruz County north to Mendocino County, California, northern Sierras and west-central Cascades of Oregon.

D. Non-habitat Factors. The Mendocino County and Oregon locations are in areas that have a substantial history of clearcutting, which would remove the mycorrhizal hosts needed by these species. The one Oregon locality of *Destuntzia rubra* has been logged since the specimens were collected.

E. Inadequate Information. The widely disjunct distributions of each species suggest that they have the potential to occupy a variety of habitats. Still, they have been found so seldom that they are regarded as rare. Further exploration of their known habitats is needed to assess population health.

F. Features of the Alternative. Elimination of the 180-year rotation in California may have negative impact on the Mendocino County habitats that support these species; mature forests in that area have already been substantially depleted.

V. Cumulative Effects Assessment. The Mendocino County localities are on state and private land. The localities in Oregon occur on federal land. It is likely that most other potential habitats will be on non-federal land.

VI. Summary. These rare species, both endemic to northern California and the Oregon Cascades, occupy mature and old-growth forest habitats that have already been seriously depleted.

VII. Mitigation. Protection of all localities of these fungi will reduce the high risk of extirpation.

A. Geographic Extent. Santa Cruz County north to Mendocino County, California, northern Sierras and west-central Cascades of Oregon.

B. Specific Habitats. *Destuntzia rubra*: California - Mendocino County, Jackson State Forest, Woodlands Camp, on hill above Camp 1 Messhall; Road #409 near Road #408; Oregon - Linn County, 1/2 mile above Roaring River Fish Hatchery.

Destuntzia fusca: California - Mendocino County, 8 miles W. of Leggett and Van Damme State Park; Oregon - Willamette National Forest, H. J. Andrews Experimental Forest, off Road 360 12.4 km NE of Blue River, and Stand 3.

C. Mitigation Measures. *Destuntzia rubra* sites in California State Forests and Parks are already protected. The *Destuntzia rubra* site in western Oregon is on private land and has been logged; if nearby BLM land (T 11 S., R 1 W., Secs. 3, 15, 16, 17,

21, 23) contain remnant mature or old-growth stands, they should be preserved until surveyed for this species. The *Desuntzia fusca* sites and nearby areas of similar habitat on the H. J. Andrews Experimental Forest should be protected and monitored for this species. Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. These species occupy low to lower-mid elevation mature and old-growth forests that have been heavily logged. Both are at high risk of extirpation; preservation of their populations and nearby, similar habitat will reduce that risk.

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- I. Species.** Rare False Truffle (*Gautieria magnicellaris*)
- II. FEMAT Rating.** 0-35-50-15
(collective rating for Rare False Truffle group)
- III. Modifications due to changes in Alternative 9.** Elimination of the 180-year rotation in northern California may reduce the future habitat available to this species.
- IV. Explanation of Rating.**
- A. Natural History.** This widely distributed but rare ectomycorrhizal false truffle, is known from only a dozen collections in all, and only 2 are within the range of the northern spotted owl. It is associated with relatively high-elevation mature to old-growth forests of mountain hemlock and true firs.
- B. Past Actions.** The California locality is in an area of extensive logging.
- C. Species Range.** Germany and Czechoslovakia; northeastern United States; former West Lava Campground (now closed) at the edge of the Mt. Washington Wilderness Area, Willamette National Forest, Oregon; Deadfall Meadows, Klamath National Forest, California.
- D. Non-habitat Factors.** The locality in Oregon has had heavy recreational use prior to its closure as a campground.
- E. Inadequate Information.** Known only from two locations in the range of the northern spotted owl.
- F. Features of the Alternative.** The California locality may occur in matrix allocation, elimination of the 180-year rotation in California will reduce suitable

habitat for the species.

V. **Cumulative Effects Assessment.** Both known localities are on federal lands; the relatively high elevation of the species localities indicate probability that most suitable habitats will be on federal land.

VI. **Summary.** Rare but not endemic, this species is known from only two localities in the range of the northern spotted owl. Past history of logging and recreation use have potentially impacted populations.

VII. **Mitigation.** Inventory both known localities and nearby areas for extent of populations; initiate process of designating a Mycological Special Interest Area at Deadfall Meadows on the Klamath National Forest in California. This is an important area mycologically and supports a diversity of fungus species including a high concentration or rare and/or endemic species of fungi.

A. **Geographic Extent.** Germany and Czechoslovakia; northeastern United States; West Lava Camp Ground, Willamette National Forest, Oregon; Deadfall Meadows, Klamath National Forest, California.

B. **Specific Habitats.** Deadfall Meadows, Klamath National Forest; the former West Lava Camp Ground, Willamette National Forest, occurs in relatively high-elevation mature to old-growth forests of mountain hemlock and true firs.

C. **Mitigation Measures.** Initially designate for protection 160 acres of similar habitat around both known localities of this species until ground survey can be conducted to determine extent of populations. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Establish a special interest Mycological Area at Deadfall Meadows, Klamath National Forest to protect high concentration of rare and endemic taxa. Manage suitable habitats in the matrix on 180-year rotation to provide for additional habitat in the vicinity of Deadfall Meadows.

D. **Benefits.** Protection of habitats in the two known localities will reduce extirpation of the species in the range of the northern spotted owl.

I. **Species.** Rare False Truffles (*Gautieria otthii* *Rhizopogon flavofibrillosus*)

II. **FEMAT Rating.** 0-35-50-15
(collective rating for Rare False Truffle group)

III. **Modifications due to changes in Alternative 9.** Elimination of the 180-year rotation in northern California may reduce the future habitat available to this species.

IV. **Explanation of Rating.**

A. **Natural History.** These are wide-ranging but rare fungi associated with mature to old-growth, mixed conifer forests at mid- to upper mid-elevations, and occur as ectomycorrhizal associates of the Pinaceae. Both are known only from four or fewer collections in the range of the northern spotted owl.

B. **Past Actions.** Known localities are in areas which have been impacted by extensive logging.

C. **Species Range.** Both species range from northern California, to the Siskiyou and central Cascade Range of Oregon; *Gautieria otthii* also occurs in Europe and Alaska; *Rhizopogon flavofibrillosus* also known from Idaho.

D. **Non-habitat Factors.** The known localities are mostly in areas subject either to extensive logging or heavy recreational use.

E. **Inadequate Information.** The wide distributions suggest that these species may be more common than now known, although extensive collecting in the range of the northern spotted owl over the last century has resulted in few known collections.

F. **Features of the Alternative.** Elimination of the 180-year rotation in northern California will reduce habitats in which these species appear to occur.

V. **Cumulative Effects Assessment.** Known localities are all on federal land and other populations are most likely to be on federal land.

VI. **Summary.** Rare but not endemic, these species appear to be at risk in most of their known localities from logging of mature and old-growth forests. Rating reflects rarity and natural history, but elimination of the 180-year rotation in northern California will reduce available habitat.

VII. **Mitigation.** Mitigation may improve ratings for these species.

A. **Geographic Extent.** Northern California, Siskiyou Mountains and central Cascade Range of Oregon.

B. **Specific Habitats.** *Gautieria otthii*: California - Marble Mtn. Wilderness Area, trail to Haypress Meadows, Klamath National Forest; Oregon - Dutcher Cr., Siskiyou National Forest; also a single collection from Alaska and several collections, including the type, from Germany.

Rhizopogon flavofibrillosus: California - Deadfall Meadows, Klamath National Forest (this area contains several rare species, including local endemics); Oregon - Three Creeks Lake and Cultus Lake (T 20 S., R 7 E., Sec. 25), Deschutes National Forest;

Head of Pistol River, Long-Term Ecological Productivity Study Site, Siskiyou National Forest; the type locality is in northern Idaho.

C. Mitigation Measures. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa. Establish a Mycological Special Interest Area at Deadfall Meadows, Klamath National Forest to protect high concentration of rare and endemic taxa. Manage suitable habitats in the matrix on 180-year rotation to provide for additional habitat in the vicinity of Deadfall Meadows.

D. Benefits. Protection of known localities with reduce risk of extirpation.

I. Species. Rare False Truffle (*Leucogaster citrinus*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9. Elimination of the 180-year rotation in California will reduce habitat available for future development of the species.

IV. Explanation of Rating.

A. Natural History. This rare, but widely distributed endemic species occurs in mature to old-growth stands of Douglas-fir, often in mixtures with western hemlock, chinquapin, manzanita and tanoak, or in stands with an abundant legacy of large, coarse woody debris at low to relatively high elevations. It is a probable ectomycorrhizal associate of Douglas-fir.

B. Past Actions.

C. Species Range. Muir Woods National Monument, Marin County, California (type locality) north to Linn and Benton Counties, Oregon.

D. Non-habitat Factors. Most of the known collections are in matrix in areas with an extensive history of logging.

E. Inadequate Information. Known from only 10 collections since it was described in 1899.

F. Features of the Alternative.

V. **Cumulative Effects Assessment.** Known locations are distributed on federal, state and private lands.

VI. **Summary.** A rare but widely distributed endemic, this species occurs primarily in matrix areas. Elimination of the 180 year rotation in California will negatively affect its future habitat.

VII. **Mitigation.** Continue protection of type locality and inventory populations. Mitigation will likely improve rating.

A. **Geographic Extent.** (see Species Range)

B. **Specific Habitats.** California - Mt. Tamalpais, Muir Woods National Monument, (type locality); Call-of-the-Wild, Santa Clara County; Duck Lake, Klamath National Forest. Oregon - Rock Creek Watershed (T 12 S., R 7 W., Sec. 14) and upper Alsea Watershed, Siuslaw National Forest; Yellow Bottom Campground, BLM (T 11 S., R 4 E., Sec. 19, SE 1/4).

C. **Mitigation Measures.** Continue protection of type locality and inventory populations to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of Mycological Special Interest Area to protect type locality and known populations, e.g. Rock Creek Watershed and Yellow Bottom Campground. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. **Benefits.** Protection of the type locality and an Oregon locality will reduce risk of extirpation of this species.

I. **Species.** Rare False Truffle (*Leucogaster microsporus*)

II. **FEMAT Rating.** 0-35-50-15
(collective rating for Rare False Truffle group)

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** This rare endemic, a probable ectomycorrhizal species, occurs at mid-elevations in mature to old-growth Douglas-fir stands or stands with an abundant legacy of coarse woody debris on the west slope of the Cascades.

B. Past Actions.

C. Species Range. Southern Cascades of Washington (Quartz Creek Big Trees area, Gifford Pinchot National Forest) to northern Cascades and Coast Ranges of Oregon.

D. Non-habitat Factors. Much of the area where this species occurs has been subjected to extensive logging or recreational use.

E. Inadequate Information. Only known from 7 collections.

F. Features of the Alternative. Most localities known for the species are in matrix areas.

V. Cumulative Effects Assessment. All 5 known locations are on federal lands.

VI. Summary. A rare endemic, this species occurs in mature to old-growth stands in matrix areas that have experienced extensive logging.

VII. Mitigation. Inventory areas of known localities, especially the type locality, for populations; initiate process of establishing a Mycological Special Interest Area at the type locality; continue preservation of the Quartz Creek Big Trees area of the Gifford Pinchot National Forest.

A. Geographic Extent. Southern Cascades of Washington to northern Cascades and Coast Ranges of Oregon.

B. Specific Habitats. Sheep Creek, S. Santiam River watershed (type locality), Willamette National Forest (T 13 S., R 5 E., Sec. 28, S. 1/2); H. J. Andrews Experimental Forest Stand 11, Willamette National Forest; Headwaters of Clackamas River along Cub Cr., Mt. Hood National Forest; Marys Peak, Siuslaw National Forest; Quartz Creek Big Trees, Gifford Pinchot National Forest (T 11 N., R 6 E., Sec. 33, SW 1/4).

C. Mitigation Measures. Inventory known locations for populations, survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Continue preservation of the Quartz Creek Big Trees area; initiate process of establishing a Mycological Special Interest Area for the type locality at Sheep Creek, Willamette National Forest.

D. Benefits. Preservation of the type and other localities will reduce risk of extirpation of the species.

- I. **Species.** Rare False Truffle (*Macowanites lymanensis*)
- II. **FEMAT Rating.** 0-12-72-17
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
 - A. **Natural History.** Extremely rare, local endemic; only known from type locality; 10 - 15 fruiting bodies in 1 sq. meter area, right in the middle of campsite at Lyman Lake, Glacier Peak Wilderness Area; old-growth mountain-hemlock/noble fir forest at 1,708 meters elevation; probably ectomycorrhizal.
 - B. **Past Actions.**
 - C. **Species Range.** Type locality, campground on east shore of Lyman Lake near wilderness ranger camp, Glacier Peak Wilderness Area, Wenatchee National Forest.
 - D. **Non-habitat Factors.** Species may be impacted by recreational use, camping, trampling and soil compaction.
 - E. **Inadequate Information.** Species only known from this one location.
 - F. **Features of the Alternatives.**
- V. **Cumulative Effects Assessment.** If other populations exist, they are likely to be on federal land, given land ownership patterns within area of type locality.
- VI. **Summary.** Species is rare and locally endemic. Rating is reflective of natural history and rarity rather than features of the alternatives.
- VII. **Mitigation.** Protection of type locality could lessen risk of extirpation.
 - A. **Geographic extent.** Type locality at Lyman Lake, Glacier Peak Wilderness Area, Wenatchee National Forest.
 - B. **Specific Habitats.** Campground on east shore of Lyman Lake (see Species Range); old-growth mountain hemlock/noble fir forest.
 - C. **Mitigation Measures.** Protect and buffer type locality. Monitor site and population to determine if management activities are necessary to protect population, such as restriction of camping activity and recreational impacts. Survey suitable habitat for other populations within the geographic area. Consider designation as Mycological Special Interest Area to protect type locality and known populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for

locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of type locality may lessen risk of extirpation. Discovery and protection of new locations for the species may also lessen risk of extirpation.

I. Species. Rare False-truffle (*Macowanites mollis*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare endemic, known from only two localities, is a ectomycorrhizal fungus of mature to old-growth Douglas-fir and possibly other Pinaceae at low to mid-elevation, mesic habitats.

B. Past Actions.

C. Species Range. Lower Tahoma Creek, Mount Rainier National Park (type locality: T 15 N., R 5 E., Sec. 34, SE 1/4); Larch Mountain, Mt. Hood National Forest, Oregon.

D. Non-habitat Factors. The Larch Mountain locality has a history of extensive logging.

E. Inadequate Information. Known only from two localities.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Both localities are on federal lands.

VI. Summary. The type locality of this rare endemic is protected in Mount Rainier National Park. Rating reflects rarity and natural history more than features of the alternatives.

VII. Mitigation. Inventory both localities for extent of populations. Initiate process of establishing a Mycological Special Interest Area in Mount Rainier National Park to protect type locality. Consider that process for the Larch Mountain locality if the species is relocated there.

A. Geographic Extent. Known only from Mt. Rainier National Park and Larch Mountain, Mt. Hood National Forest.

B. Specific Habitats. Lower Tahoma Creek, Mount Rainier National Park (type locality: T 15 N., R 5 E., Sec. 34, SE 1/4; Larch Mountain, Mt. Hood National Forest, Oregon.

C. Mitigation Measures. Inventory both localities to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of populations. Consider establishing a Mycological Special Interest Area in Mount Rainier National Park to protect the type locality; consider that process for the Larch Mountain locality if the species is relocated there. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of known localities will reduce risk of extirpation of the species.

I. Species. Rare False Truffle (*Martellia idahoensis*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Rare in the range of the northern spotted owl, this species was originally described from about a dozen collections in northern Idaho. It is presumably ectomycorrhizal with true firs and possibly other Pinaceae at mid- to upper mid-elevations.

B. Past Actions.

C. Species Range. Northern Idaho; two locations in Oregon: Marys Peak, Coast Range, Siuslaw National Forest, at 3,000 ft. elevation, and Lamb Butte Scenic Area, Cascade Range, Willamette National Forest, at 5,000 ft. elevation. The latter area has been recommended for preservation because of its concentration of rare and endemic fungal species. (see species group *Chroogomphus loculatus*).

D. Non-habitat Factors

E. Inadequate Information. The disjunct distribution of this species in Oregon and the disjunctions of those localities from its more common populations in Idaho suggest that it may be more common than now known. Further attention should be

devoted to finding other populations, especially in old-growth true fir stands, to determine how rare it really is.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. Distribution under old-growth true firs suggests populations primarily on federal land.

VI. Summary. This species is known from only two areas in Oregon, but these already have some degree of protection. Association with old-growth true firs suggests preservation of that kind of habitat is important for this species viability.

VII. Mitigation. Continued protection of the two localities of occurrence and general retention of old-growth true fir habitats will provide as good a protection for this rare species as can be recommended at this time.

A. Geographic Extent. Northern Idaho and two locations in Oregon.

B. Specific Habitats. Marys Peak, Coast Range, Siuslaw National Forest, at 3,000 ft. elevation and Lamb Butte Scenic Area, Cascade Range, Willamette National Forest, at 5,000 ft. elevation.

C. Mitigation Measures. Protect the two known localities. The Marys Peak area is part recreation area, part noble fir buffer zone. The Lamb Butte Scenic area has been recommended for designation as a Mycological Special Interest Area because of the concentration of rare and endemic fungal species. The protected status of both areas should be continued. Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the known localities will lessen risk of extirpation of this species from Oregon.

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- I. Species.** Rare False Truffles (*Octavianina macrospora*; *Octavianina papyracea*)
 - II. FEMAT Rating.** 0-2-83-15
(collective rating for Rare Bolete/False Truffle group)
 - III. Modifications due to changes in Alternative 9.**
 - IV. Explanation of Rating.**

A. Natural History. Rare, local endemics, known only from the type collections, occur as probable ectomycorrhizal associates in mature to old-growth forests in mesic habitats; *Octavianina macrospora* with Douglas-fir and western hemlock in the foothills near Mt. Hood, *Octavianina papyracea* in mixed, coastal forests of Douglas-fir, western hemlock, Sitka spruce and coast redwood in the coastal fog belt.

B. Past Actions.

C. Species Range. *Octavianina macrospora*: Oregon, the former Twin Bridges Forest Camp, Mt. Hood National Forest. *Octavianina papyracea*: California, Spruce Cove, Trinidad, Humboldt County, California.

D. Non-habitat Factors. Both type localities are subject to heavy recreational use with attendant trampling and soil compaction.

E. Inadequate Information. Collected in the 1930's, the single localities of both species are designated in the herbarium notes by obsolete names. Historical research is needed to identify the precise localities.

F. Features of the Alternative.

V. Cumulative Effects Assessment. The *Octavianina macrospora* locality is at low elevation on federal land in a habitat type that is well represented on private land as well; these habitat types have been extensively logged. The *Octavianina papyracea* locality is unknown ownership but in an area subject to heavy recreational development and use.

VI. Summary. Extremely rare endemics known only from the type localities, these two species occur in lowland areas of intensive logging and recreational activity. Their type localities should be relocated and preserved. Ratings reflect natural history, rarity and past actions more than features of the alternatives.

VII. Mitigation. Relocate type localities, conduct intensive inventory for populations in those localities and nearby areas with similar habitat. Establish Mycological Special Interest Areas to preserve the type localities or, if those localities have been disturbed to the point that mature or old-growth habitat no longer exists, seek nearby locations on federal land for preservation.

A. Geographic Extent. *Octavianina macrospora*: Oregon, the former Twin Bridges Forest Camp, Mt. Hood National Forest. *Octavianina papyracea*: California, Spruce Cove, Trinidad, Humboldt County, California.

B. Specific Habitats. Same as in item II.

C. Mitigation Measures. Relocate type localities, conduct intensive inventory for populations in those localities and nearby areas with similar habitat, establish buffer around known locations to provide for adequate protection of population. Establish Mycological Special Interest Areas to preserve the type localities or, if those localities have been disturbed to the point that mature or old-growth habitat no longer exists,

seek nearby locations on federal land for preservation (Mt. Hood National Forest for *Octavianina macrospora*, Redwood National Park for *Octavianina papyracea*). Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Preservation of type localities of these extremely rare endemics will reduce the high risk of their extirpation.

I. Species. Rare False truffle (*Rhizopogon brunneiniger*)
(this species was listed as *Rhizopogon brunneicolor* in FEMAT)

II. FEMAT Rating. 0-35-50-15
(collective rating of Rare False Truffle group)

III. Modifications due to changes in Alternative 9. Elimination of the 180-year rotation in northern California may reduce the habitat available to the species.

IV. Explanation of Rating.

A. Natural History. This rare endemic occurs in widely dispersed localities in dry to moderate habitats at low to relatively high elevations in association with mature to old-growth mixtures of Douglas-fir, western hemlock, true firs and pines.

B. Past Actions. Extensive logging have impacted populations or restricted distribution.

C. Species Range. Northern Oregon Cascades, type locality at Barlow Campground, Mt. Hood National Forest; Coast Ranges and Siskiyou Mountains; Klamath Mountains of California (Deadfall Meadows); plus an outlier collection in Marin County, California.

D. Non-habitat Factors. Most of the known localities are in areas that have experienced extensive logging.

E. Inadequate Information. Known from only 5 collections. The widely dispersed, known localities suggest that this species may be more common than now recognized.

F. Features of the Alternative. Most of the known localities are in matrix area.

V. Cumulative Effects Assessment. Three of the five known localities are on federal land; the other two are on private land.

VI. **Summary.** This rare endemic is known only from five localities from Marin County, California to the northern Oregon Cascades. Assessment reflects rarity and habitat features more than features of the alternatives.

VII. **Mitigation.** Inventory type locality on the Mt. Hood National Forest and the Deadfall Meadows area on the Klamath National Forest for populations and initiate process of establishing Mycological Special Interest Area.

A. **Geographic Extent.** see Species Range.

B. **Specific Habitats.** Oregon: type locality at Barlow Forest Camp, Mt. Hood National Forest (T. 3 S., R 9 E., Sec. 28 SW 1/4); W. of Philomath, Benton Co., private land. California: Deadfall Meadows, Klamath National Forest; Inverness, Marin County (private land near Point Reyes National Seashore).

C. **Mitigation Measures.** Inventory type locality on the Mt. Hood National Forest and the Deadfall Meadows are on the Klamath National Forest; survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Establishing Mycological Special Interest Area to protect these populations. Manage matrix in Deadfall Meadows area for 180+ year rotation. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. **Benefits.** Protection of the type locality at Barlow Camp, and the Deadfall Meadows area (which contains a concentration of local endemics and other rare species) will reduce the risk of extirpation of this species.

I. **Species.** Rare False Truffle (*Rhizopogon evadens* var. *subalpinus*)

II. **FEMAT Rating.** 0-35-50-15
(collective rating for Rare False Truffle group)

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Widely distributed but rare, this species occurs in upper mid-elevations to near timberline as an ectomycorrhizal fungus of mountain hemlock, true firs, and possibly other Pinaceae.

B. **Past Actions.**

C. Species Range. Originally described from Idaho, it since has been found in widely disjunct locations from just north of Mt. Rainier National Park south to Siskiyou County, California. One locality, the Lamb Butte Scenic Area, has been recommended for preservation because of its concentration of rare and endemic fungal species (see species group *Chroogomphus loculatus*).

D. Non-habitat Factors.

E. Inadequate Information. The disjunctions in known distribution may be an artifact, insofar as mountain hemlock stands are more or less continuous in the Oregon Cascades. Further attempts to collect the species may reveal that it is less rare than currently thought.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. The relatively high elevational distribution in the Cascades and Klamath Mountains under mountain hemlock and true firs indicates that most or all populations are on federal lands.

VI. Summary. Widely distributed from Oregon to northern California but with large disjunctions between known localities, this species may be more common than now known. The rating more reflects its natural history and rarity more than features of the alternative.

VII. Mitigation. Protection of high elevation old-growth mountain hemlock and true fir stands should adequately minimize risk of extirpation.

A. Geographic Extent. Originally described from Idaho, it since has been found in widely disjunct locations from just north of Mt. Rainier National Park south to Siskiyou County, California.

B. Specific Habitats. Washington - Suntop Mtn., Mt. Baker-Snoqualmie National Forest; Peterson Prairie, Gifford Pinchot National Forest. Oregon - Tillie Jane Campground and Still Creek Campground, Mt. Hood National Forest; Wickiup Plains and east slope of North Sister, Deschutes National Forest; Lamb Butte Scenic Area and Waldo Lake, Willamette National Forest; Windigo Pass, Umpqua National Forest; Cascade Pass and Miller Lake, Winema National Forest; Deadfall Meadows, Klamath National Forest.

C. Mitigation Measures. Preservation of extensive tracts of mountain hemlock should protect this species. The Lamb Butte Scenic Area, one of the localities for this species, has been recommended for protection and designation as a Mycological Special Interest Area because of its concentration of rare and endemic fungal species (see species group *Chroogomphus loculatus*). Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Preservation of habitat over the range of the species should adequately prevent extirpation.

I. Species. Rare False Truffle (*Rhizopogon exiguus*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare endemic occurs on moist to dry sites in mature to old-growth forests or forests with an abundant legacy of large, coarse woody debris. It forms ectomycorrhizae with Douglas-fir and possibly western hemlock.

B. Past Actions.

C. Species Range. Silver Springs Camp Ground, Mt. Baker-Snoqualmie National Forest, Washington (type locality); Coast Ranges and Siskiyou Mountains of Oregon.

D. Non-habitat Factors. The type locality is in a heavily used recreational area, with attendant trampling and soil compaction. Other localities are in areas with histories of extensive logging.

E. Inadequate Information. Known from only four localities.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Due to the low-elevation habitats of this species, its distribution is likely to be as much on non-federal land as on federal land.

VI. Summary. This rare endemic occurs at low elevations in areas with extensive logging history. Much of its potential habitat has consequently been intensively disturbed.

VII. Mitigation. Initiate the process of establishing a Mycological Special Interest Area for protection of type locality; inventory other localities to determine extent of populations.

A. Geographic Extent. Lower mid-elevations, Cascade Mountain of Washington (one collection); Coast Range and Siskiyou Mountains of Oregon.

B. Specific Habitats. Washington - Silver Springs Camp Ground, Mt. Baker-Snoqualmie National Forest (type locality: T 18 N., R 10 E., Sec. 3, NW 1/4). Oregon - Marys Peak, Siuslaw National Forest, T 12 S., R 7 W., Sec. 26, SE 1/4; Waters

Creek, Buckeye logging unit #2, Siskiyou National Forest; 1 mile S. of Mapleton (private land).

C. Mitigation Measures. Inventory populations at type locality with special attention to areas not developed for recreational use and initiate process of establishing a Mycological Special Interest Area to protect the type locality; inventory populations at Marys Peak with the intention of either establishing a Mycological Special Interest Area or extending the boundaries of the present Botanical-Scenic Special Interest Area. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the type locality and Marys Peak population will reduce the risk of extirpation of the species.

I. Species. Rare False truffle (*Rhizopogon inquinatus*)

II. FEMAT Rating. 0-35-50-15
(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare species is associated as an ectomycorrhizal fungus with mature to old-growth Douglas-fir or younger forests with an abundant legacy of large, coarse woody debris at mid- to upper mid-elevations.

B. Past Actions.

C. Species Range. Idaho (type and only collection); South Santiam River watershed; Willamette National Forest, Oregon.

D. Non-habitat Factors. Known localities are in areas with extensive history of logging or present, intensive recreational use.

E. Inadequate Information. Known from only 4 collections.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All known locations are on federal land.

VI. **Summary.** Originally described from a single collection in Idaho, this species is known in the range of the northern spotted owl only from the South Santiam River watershed of the western Oregon Cascades.

VII. **Mitigation.** Inventory populations at known localities in the South Santiam Watershed; initiate process of establishing a Mycological Special Interest Area at one or both South Santiam localities.

A. **Geographic Extent.** (see Species Range)

B. **Specific Habitats.** Tombstone Pass, Willamette National Forest (T 13 S., R 5 E., Sec. 36, SE 1/4 and T 13 S., R 6 E., Sec. 31, SW 1/4); Longbow Campground, T 13 S., R 4 E., Sec. 32, NW 1/4).

C. **Mitigation Measures.** Inventory populations at known localities in the South Santiam Watershed; survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of Mycological Special Interest Area at the Tombstone Pass locality. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. **Benefits.** Protection of at least one of the South Santiam localities will reduce risk of extirpation of the species in Oregon.

I. **Species Group.** Undescribed Rare Taxa (False Truffles)

(*Alpova* sp. nov. #Trappe 9730)
(*Arcangeliella* sp. nov. #Trappe 12382)
(*Gastroboletus* sp. nov. #Trappe 2897)
(*Rhizopogon* sp. nov. #Trappe 9432)

II. **FEMAT Rating.** 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** These rare endemics are known only from the type localities in southwestern Oregon at mid- to high elevations in mature to old-growth stands of Douglas-fir, knobcone pine, sugar pine and manzanita or pure stands of Shasta fir.

B. **Past Actions.** Extensive logging in these forests has removed much of the

mature to old-growth habitat in which these species occur.

C. Species Range. Siskiyou Mountains of southwestern Oregon.

D. Non-habitat Factors.

E. Inadequate Information. The Siskiyou mountains contain a wealth of endemic vascular plants. Most likely there are many locally endemic fungi as well, but intensive exploration for such fungi has never been undertaken, though much needed.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Most of the mid- to high elevation forest of the Siskiyous is federal land.

VI. Summary. Rating reflects the rarity of these locally endemic species in a area that has been extensively logged.

VII. Mitigation. Protection of type localities and adjacent, similar habitats will reduce risk of extirpation of these species.

A. Geographic Extent. Siskiyou Mountains of southwestern Oregon

B. Specific Habitats.

Alpova #9730: Slurpy #6 timber sale area, Siskiyou National Forest.

Gastroboletus #2897: Jackson Gap, Rogue River National Forest, T. 41 S., R. 2 W., Sec. 1, SE 1/4.

Rhizopogon #9432, Siskiyou National Forest, China Hat, Galice Ranger District, Siskiyou National Forest.

C. Mitigation Measures. Initially designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of special interest area to protect type locality and known populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the type localities plus the larger populations they represent in the area will reduce risk of extirpation.

- I. **Species.** Rare False truffle (*Alpova* sp. nov. #Trappe 1966)
- II. **FEMAT Rating.** 0-0-60-40
(collective rating for Rare False Truffle - Undescribed Taxa group)
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
 - A. **Natural History.** This rare, local endemic is known only from the type locality in a mature stand of Douglas fir at mid-elevation.
 - B. **Past Actions.**
 - C. **Species Range.** Known only from a mature Douglas-fir stand along Hackleman Creek, Willamette National Forest, T 13 S., R 6 E., Sec. 25, NE 1/4. Species is probably ectomycorrhizal with Douglas-fir.
 - D. **Non-habitat Factors.** Extensive timber harvest in the vicinity may have removed much of the mature forest near the type locality beyond the scenic corridor of U. S. Highway 20.
 - E. **Inadequate Information.** For lack of intensive survey, the extent of the population of this species is unknown beyond the type locality.
 - F. **Features of the Alternative.**
- V. **Cumulative Effects Assessment.** The type locality and probably most other populations at that elevation are in federal ownership.
- VI. **Summary.** Rating reflects the rarity of this locally endemic species in an area that has been extensively logged.
- VII. **Mitigation.** Protection of the type locality and adjacent, similar habitats will reduce risk of extirpation of this species.
 - A. **Geographic Extent.** Hackleman Creek, Willamette National Forest
 - B. **Specific Habitats.** Mature Douglas-fir forest at mid elevation. T 13 S., R 6 E., Sec. 25, NE 1/4.
 - C. **Mitigation Measures.** Initially designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of Mycological Special Interest Area to protect type locality and known populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse

impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the type locality plus the larger populations it represents in the area will reduce risk of extirpation.

I. Species.

Rare False Truffles

(*Arcangeliella* sp. nov. #Trappe 12359)

(*Elaphomyces* sp. nov. #Trappe 1038)

(*Thaxterogaster* sp. nov. #Trappe 4867, 6242, 7427, 7962, 8520)

Rare Truffles

(*Tuber* sp. nov. #Trappe 2302)

(*Tuber* sp. nov. #Trappe 12493)

II. FEMAT Rating. 0-0-60-40

(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. These rare endemics inhabit mature to old-growth coastal Sitka-spruce and western hemlock forests and forest fragments or younger forests with an old-growth legacy of coarse woody debris in the Oregon coastal fog belt. All are probable mycorrhizal associates with Sitka spruce, western hemlock and/or Douglas-fir.

B. Past Actions. Extensive logging has removed most of the mature to old-growth of coastal forests of Oregon, thereby removing habitat for these species.

C. Species Range. Lane, Lincoln and Tillamook Counties, Oregon

D. Non-habitat Factors. Intensive recreational use may also have impact on these species through trampling and soil compaction.

E. Inadequate Information. All but the *Thaxterogaster* species are known only from the type localities.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Most of the remaining habitat for these species is on federal or state park land.

VI. **Summary.** The species are rare and locally endemic. Rating reflects their natural history and rarity more than features of the alternatives.

VII. **Mitigation.** Protection of type and paratype localities could lessen the present substantial risk of extirpation.

A. **Geographic Extent.** Lane, Lincoln and Tillamook Counties, Oregon

B. **Specific Habitats.**

Arcangeliella sp. nov. #Trappe 12359: Lower Cummins Creek Trail, Cummins Creek Wilderness Area, Siuslaw National Forest, T 15 S., R 11 W., Sec. 18, NE 1/4.

Elaphomyces sp. nov. #Trappe 1038: Cascade Head Experimental Forest, Siuslaw National Forest, T 6 S., R 10 W., Sec. 18.

Thaxterogaster sp. nov. #Trappe 4867: Cape Lookout

State

Park, T 2 S.,

R11 W.,

Sec. 36;

#6242: Cape Perpetua Scenic Area, Siuslaw National Forest, T 15 S., R 12 W.,

Sec. 3,

NE 1/4;

#7427: Yachats, private land, T 14 S., R 12 W., Sec. 25, NE 1/4;

#7962: Siuslaw National Forest, T 4 S., R 10 W., Sec. 7, SW 1/4;

#8520: 1/2 mile north of Pacific City along Three Capes Highway, private land.

Tuber sp. nov. #Trappe 2302: Cascade Head Experiment Forest, Siuslaw National Forest, T 6 S., R 10 W., Sec. 18, E. 1/2.

Tuber sp. nov. #Trappe 12493: Cummins Cr. Trailhead, Siuslaw National Forest,

T 15 N., R 11 W., Sec. 7, SE 1/4.

C. **Mitigation Measures.** Initially designate 160 acres of similar habitat around the type locality of each species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Establish Mycological Special Interest Areas to protect type localities and known populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. **Benefits.** Protection of type localities may lessen risk of extirpation. Discovery and protection of new populations may also decrease risk of extirpation.

I. **Species.** Rare False Truffle (*Chamonixia pacifica* sp. nov. #Trappe 12768)

II. FEMAT Rating. 0-35-50-15

(collective rating for Rare False Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Endemic to coastal Oregon and the Cascade Range of Washington to upper mid-elevations; probably an ectomycorrhizal associate of Pinaceae in mature to old-growth forests with various mixtures of Douglas-fir, western hemlock, Sitka spruce and Pacific silver fir. It is known from only 9 collections.

B. Past Actions.

C. Species Range. Coastal Oregon from Lincoln County north to the Columbia River and the North Cascades of Washington in the Skagit River watershed.

D. Non-habitat Factors. Logging of coastal forests has left little of the mature or old-growth forest in which this species has been found.

E. Inadequate Information. The disjunct nature of its distribution between coastal Oregon and Skagit watershed localities in Washington suggests the need for more extensive survey of the intervening areas for this species.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Most of the known localities are on federal land; aside from State Parks, other ownerships in the coastal area are private land with a history of logging.

VI. Summary. This rare endemic is particularly at risk in its coastal habitats, where relatively little mature or old-growth forest remains. The rating more reflects its natural history and rarity than features of the alternatives.

VII. Mitigation. Preservation of mature to old-growth coastal forests will reduce risk of extirpation in those habitats.

A. Geographic Extent. Coastal Oregon from Lincoln County north to the Columbia River and the North Cascades of Washington in the Skagit River watershed.

B. Specific Habitats. Oregon - 7 miles south of Newport at Passmore Rd. (private land); Cascade Head Experimental Forest, Siuslaw National Forest (5 collections); Camp Meriweather (Boy Scouts of America); near Seaside (private land). Washington - west of Baker Lake, Mt. Baker-Snoqualmie National Forest; Rainy Pass, North Cascades Highway Corridor, Okanogan National Forest.

C. Mitigation Measures. Coastal mature to old-growth forests in northern Oregon

should be surveyed to identify additional populations. Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Consider designation of Mycological Special Interest Area at Cascade Head Experimental Forest to protect the largest known population. Survey suitable habitat to find additional populations. Develop management guidelines to protect known populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. This rare endemic will be at reduced risk of extirpation if known localities are protected, and suitable habitat is provided by managing for mature and old-growth forests in northern coastal Oregon.

I. Species. Rare Undescribed Taxa (Bolete) (*Gastroboletus* sp. nov. #Trappe 7515)

II. FEMAT Rating. 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This showy, rare and locally endemic bolete is known only from the type locality in an old-growth mountain hemlock stand at a high elevation. Probably ectomycorrhizal with mountain hemlock.

B. Past Actions.

C. Species Range. Oregon, Cleatwood Picnic Area, Crater Lake National Park.

D. Non-habitat Factors. The type locality is in a heavily used recreational site.

E. Inadequate Information. Only known from this location, but probably present in nearby, similar old-growth mountain hemlock forests.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. The elevation and habitat of the type locality suggest that the range of the species will be entirely on federal land.

VI. Summary. A rare, local endemic, this species is known only from Crater Lake National Park in a developed picnic area; rating reflects rarity and natural history rather than features of the alternative.

VII. Mitigation. Intensively survey the high-elevation, old-growth mountain hemlock stands of Crater Lake National Park for populations of this species with special emphasis on areas outside developed recreational sites. Establish a Mycological Special Interest Area to preserve the type locality.

A. Geographic Extent. Known only from the type locality.

B. Specific Habitats. Oregon, Cleatwood Picnic Area, Crater Lake National Park.

C. Mitigation Measures. Intensively survey the high-elevation, old growth mountain hemlock stands of Crater Lake National Park for populations of this species with special emphasis on areas outside developed recreational sites. Monitor known location for recreation impacts. Delay formal description of the species in hopes of finding populations and another collection to serve as holotype outside the developed picnic site. Establish a Mycological Special Interest Area to preserve the type locality. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Preservation of the type locality will reduce risk of extirpation of the species.

I. Species. Rare Undescribed Taxa (Bolete/False truffles)
(*Gastrosuillus* sp. nov. #Trappe 7516)
(*Gymnomyces* sp. nov. #Trappe 7545)

II. FEMAT Rating. 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9. Elimination of the 180-year rotation in northern California will greatly reduce future habitat available to these species.

IV. Explanation of Rating.

A. Natural History. These rare endemics, probably ectomycorrhizal associates of Pinaceae and known only from the type collections, occur from 6,000 to 7,000 ft. elevation in mature to old-growth forests of true firs and western white pine and other conifers.

B. Past Actions.

C. Species Range. Klamath Mountains, Klamath National Forest, northern California. The type locality of *Gastrosuillus* #Trappe 7516 is Deadfall Meadows, that of *Gymnomyces* #Trappe 7545 is Carter Meadows summit.

D. Non-habitat Factors. Extensive logging has reduced that mature to old growth habitat in which these species occur.

E. Inadequate Information. Only known from these locations, but little collecting of false truffles has been done in the area. Occurrence of 3 rare, locally endemic species in a poorly collected area suggests that it may be a center of endemism. Three other rare but not endemic species, *Gautieria otthii*, *Rhizopogon brunneiniger*, and *Rhizopogon flavifibrillosus*, have also been collected at Deadfall Meadows. The infrequent but widely distributed *Rhizopogon abietis* also occurs at the site.

F. Features of the Alternative. Elimination of the 180-year rotation in northern California reduces opportunities to maintain habitats in which these species occur.

V. Cumulative Effects Assessment. Because of their occurrence at relatively high elevation, the range of these species is likely to be on federal land.

VI. Summary. These species rare local endemics in an area that probably has other rare endemics. The rating reflects natural history and rarity.

VII. Mitigation. Preserve type localities. Inventory general areas for populations. Consider the Deadfall Meadows area for designation as a Mycological Special Interest Area. Retain mature to old-growth stands and maintain a 180+ year rotation in similar habitats in the area.

A. Geographic Extent. (see Species Range)

B. Specific Habitats. Mature to old-growth stands of true firs, western white pine, and other conifers.

C. Mitigation Measures. Initially designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Establish mycological special interest area consisting of mature to old-growth stands in vicinity of Deadfall Meadows to protect type locality and known populations, and the concentration of rare fungal species which occur here. Survey suitable habitat to find additional populations. Inventory and monitor populations in general area for these and other endemics. Maintain 180+ year rotations in similar habitats of the area. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of type localities and nearby, similar habitats and maintenance of 180+ year rotations in the general areas will reduce risk of extirpation.

- I. **Species.** Rare Undescribed Taxa (Bolete) (*Gastrosuillus* sp. nov. #Trappe 9608)
- II. **FEMAT Rating.** 0-0-60-40
(collective rating for Rare Undescribed Taxa group)
- III. **Modifications due to changes in Alternative 9.** Elimination of the 180-year rotation in northern California may greatly reduce the future habitat available to this species.
- IV. **Explanation or Rating.**
- A. **Natural History.** This local endemic, known only from the type collection, occurs at an elevation of 6,000 ft. in association with sugar pine in a mature, mixed conifer forest.
- B. **Past Actions.**
- C. **Species Range.** Just outside Lassen National Park, 1 mi. north of the junction of ~~9~~ Highways 36 and 89, Lassen National Forest, California.
- D. **Non-habitat Factors.** Heavy recreational use of the area may impact the populations from recreational development, soil compaction, etc.
- E. **Inadequate Information.** The area has never been surveyed for fungi, so extent of the population is unknown.
- F. **Features of the Alternative.** Elimination of the 180-year rotation in northern California reduces opportunities to maintain habitats in which this species occurs.
- V. **Cumulative Effects Assessment.** The area includes federal public and private lands.
- VI. **Summary.** Species is rare and locally endemic in an area of heavy recreational use. Rating reflects rarity more than features of the alternatives.
- VII. **Mitigation.** Protection of the type locality and nearby, similar habitats would lessen risk of extirpation.
- A. **Geographic Extent.** Just outside Lassen National Park, 1 mile north of the junction of State Highways 36 and 89, Lassen National Forest, California.
- B. **Specific Habitats.** Known only from the type locality.
- C. **Mitigation Measures.** Initially designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Maintain 180-year rotations in similar habitats of the area. Establish Mycological Special Interest Area to protect type locality and known populations.

Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of type locality and nearby, similar habitats and maintenance of 180-year rotations in the general area will reduce risk of extirpation.

I. Species. Rare Undescribed Taxa (False Truffle) (*Gymnomyces* sp. nov. #Trappe 4703, 5576)

II. FEMAT Rating. 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare endemic is known only from 2 collections in relict stands of mature noble fir at upper mid-elevations of Marys Peak, Siuslaw National Forest. This is one of only a very few stands of noble fir in the Coast Range of Oregon.

B. Past Actions.

C. Species Range. Summit and adjacent areas of Marys Peak, Siuslaw National Forest.

D. Non-habitat Factors. The type and other locality are in an area of heavy recreational use and surrounded by extensive clearcuts.

E. Inadequate Information. The extent of populations of this species at Marys Peak or other relict stands of noble fir in the Coast Range is unknown.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All likely localities are on federal land.

VI. Summary. Species is rare and locally endemic in disjunct, relict stands of noble fir in the Oregon Coast Range. Rating reflects its natural history and rarity more than features of the alternatives.

VII. Mitigation. Protection of all noble fir stands in the Oregon Coast Range will reduce risk of extirpation of this species.

A. Geographic Extent. Summit and adjacent areas of Marys Peak, Siuslaw National Forest.

B. Specific Habitats. Relict stands of noble fir.

C. Mitigation Measures. Monitor present populations, which are in an area of heavy recreational use but protected from logging. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Protect type locality from recreational development. Inventory other noble fir stands in the Oregon Coast Range for the species. Designate Mycological Special Interest Area to protect type locality and known populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Continued protection of present localities, in addition to locating and protecting additional populations will reduce risk of extirpation.

I. Species group. Rare Undescribed Taxa (False Truffles)
(*Gymnomyces* sp. nov. #Trappe 5052)
(*Martellia* sp. nov. #Trappe 311, 649)

II. FEMAT Rating. 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. These rare endemics are known only from the type collections in mature to old-growth mountain hemlock and Pacific silver fir. Both are likely ectomycorrhizal associates with hemlock and possibly with fir.

B. Past Actions.

C. Species Range. Oregon, Phlox Point, Mt. Hood, Mt. Hood National Forest.

D. Non-habitat Factors. The type localities for these two species are a heavily used recreation area. Trampling and soil compaction may have serious impacts.

E. Inadequate Information. Presumably the two species occur in similar habitats in the vicinity of the type localities. Monitoring and surveys should be conducted to determine the extent of the populations.

F. Features of the Alternative.

V. Cumulative Effects Assessment. The high-elevation location of the type localities suggest that most or all populations will be on federal land.

VI. Summary. The species are rare and endemic. The rating reflects natural history and rarity more than features of the alternatives.

VII. Mitigation. Minimizing disturbance in the type localities and nearby similar habitats, in addition to monitoring for impacts, and providing adequate protection for known locations, should lessen the risk of extirpation.

A. Geographic Extent. Oregon, Phlox Point Picnic Ground, Mt. Hood, Mt. Hood National Forest.

B. Specific Habitats. Mature to old-growth mountain hemlock and Pacific silver fir stands, T 3 S., R 9 E., Sec. 7., W. 1/2.

C. Mitigation Measures. Minimize recreational impact in type locality, survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Designate Mycological Special Interest Area to protect type locality and known populations. Survey relatively undisturbed, similar habitats on Mt. Hood for additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the type locality and relatively undisturbed, similar habitats on Mt. Hood may reduce risk of extirpation.

I. Species. Rare Undescribed Taxa (False Truffle) (*Gymnomyces* sp. nov. #Trappe 1690, 1706, 1710)

II. FEMAT Rating. 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare endemic is known only from 3 collections at upper mid-elevations of the western Oregon Cascades, Willamette National Forest, in mature to old-growth stands of grand fir, noble fir, Pacific silver fir and mountain

hemlock.

B. Past Actions.

C. Species Range. Lamb Butte Scenic Area and Wildcat Mountain Research Natural Area, Willamette National Forest.

D. Non-habitat Factors. Much of the intervening area between the two known locations has been clearcut.

E. Inadequate Information. The two known localities of this species are only about 18 miles apart; the areas adjacent to or between the localities have not been inventoried for presence of additional populations.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All likely localities are on federal land.

VI. Summary. Species is rare and locally endemic. Rating reflects its natural history and rarity more than features of the alternatives.

VII. Mitigation. Protection of similar habitats between the known localities will reduce risk of extirpation. Establishment of a Mycological Special Interest Area in the vicinity of Lamb Butte Scenic Area will provide protection for this species and many other rare and endemic species of fungi.

A. Geographic Extent. Western Oregon Cascades between the Santiam and McKenzie Rivers.

B. Specific Habitats. Lamb Butte Scenic Area and Wildcat Mountain Research Natural Area, Willamette National Forest

C. Mitigation Measures. Monitor present populations, which are already in protected areas. Inventory area between Lamb Butte and Wildcat Mountain for additional populations, including the H. J. Andrews Experimental Forest. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Propose establishment of Mycological Special Interest Area to provide for the high concentration of rare and endemic fungus species in this area. Proposed boundaries should extend from the Lamb Butte Scenic Area to merge with the Ollalie Ridge Research Natural Area, and encompass the entire ridge system at least to McLennan Mtn. and downslope to adjacent roads on the west and south slopes, and to elevations of about 3,500 ft. on the north and east slopes. Since this area appears to harbor a concentration of rare and endemic species, other rare species can be expected to be found.

D. Benefits. Continued protection of present localities, along with locating and protecting additional populations will reduce risk of extirpation.

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- I. **Species Group.** Rare Undescribed Taxa (False Truffles)
(*Hydnотrya* sp. nov. #Trappe 787, 792)
(*Martellia* sp. nov. #Trappe 5903)
- II. **FEMAT Rating.** 0-0-60-40
(collective rating for Rare Undescribed Taxa group)
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. **Natural History.** These rare species are endemic to old-growth Pacific silver fir/mountain hemlock forests of the type localities at elevations of about 6,000 ft.; probably form ectomycorrhizae with one or both tree species.
- B. **Past Actions.**
- C. **Species Range.** Mt. Jefferson Wilderness Area, Willamette National Forest, Oregon.
- D. **Non-habitat Factors.**
- E. **Inadequate Information.** The range of these species is possibly broader than indicated above, but surveys of similar habitats in the Oregon Cascades are needed to determine the broader distribution.
- F. **Features of the Alternative.**
- V. **Cumulative Effects Assessment.** Given the known habitats and elevations, these species are likely to occur mostly or entirely on federal lands.
- VI. **Summary.** Both species are rare and locally endemic. The rating reflects natural history and rarity more than features of the alternatives.
- VII. **Mitigation.** Maintain protection of known localities and similar habitats in the central Oregon Cascade Range.
- A. **Geographic Extent.** Mt. Jefferson Wilderness Area, Willamette National Forest, Oregon.
- B. **Specific Habitats.** *Hydnотrya* sp. nov. #Trappe 787, 792: Jefferson Park, Mt. Jefferson Wilderness Area, Willamette National Forest, T 10 S., R 8 E., Sec. 15, NE 1/4; *Martellia* sp. nov. #Trappe 5903: Shirley Lake, Mt. Jefferson Wilderness Area, Willamette National Forest T 11 S., R 8 E., Sec. 33, NW 1/4.

C. Mitigation Measures. Continue protection as afforded by wilderness area designation; protect type localities from fire. Monitor and survey for additional populations. Consider designation of Mycological Special Interest Area to protect type localities and known populations. Consider designation of special interest area to protect type locality and known populations. Develop and maintain GIS layer and associated database on rare, endemic fungi and type localities.

D. Benefits. Continued protection, including fire control, will minimize risk of extirpation.

I. Species. Rare Undescribed Taxa (Truffle) (*Hydnотrya subnix* sp. nov. #Trappe 1861)

II. FEMAT Rating. 0-0-60-40
(collective rating for Rare Undescribed Taxa group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Fruiting in spring under a small snowbank in an old-growth stand of Pacific silver fir, with which it is probably ectomycorrhizal.

B. Past Actions. Logging in vicinity of known location may have impacted population or removed suitable habitat.

C. Species Range. Known only from the type locality in Washington, Gifford Pinchot National Forest, E. Fork Lewis River near Gumboot Mountain (T 5 N., R 5 E., Sec. 33).

D. Non-habitat Factors. The present extent of logging in the type locality since the type was collected in 1969 is unknown.

E. Inadequate Information. This truffle has been found only once, and the collector has not visited the area since. The area and surrounding remaining stands should be rechecked for this species.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. The type locality is on federal land but near private land. Other populations could be in either ownership to the degree that mature stands are left.

VI. Summary. This rare species is in an area subject to considerable past logging and could be in danger of extirpation.

VII. Mitigation. Protection of the type locality or, if that has been logged, nearby mature Pacific silver fir stands may prevent extirpation of the species if it still exists.

A. Geographic Extent. Known only from the type locality in Washington.

B. Specific Habitats. Gifford Pinchot National Forest, E. Fork Lewis River, near Gumboot Mountain (see Species Range).

C. Mitigation Measures. The type locality and surrounding or nearby stands of similar habitat should be fully protected in the Gumboot Mountain area. Designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Designate Mycological Special Interest Area to protect type locality and known populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of known location may save the species from extirpation, assuming it still exists.

I. Species. Rare Truffle (*Balsamia nigrens*)

II. FEMAT Rating. 0-18-60-23
(collective rating for Rare Truffle group)

III. Modifications due to changes in Alternative 9. Elimination of the 180-year rotation in northern California may reduce the future habitat available to this species.

IV. Explanation of Rating.

A. Natural History. This rare fungus, endemic from the central Sierras of California to Yamhill County, Oregon, occurs in low-elevation, xeric sites with mature forests comprised of pines, oaks and/or Douglas-fir, or forests with an abundant legacy of coarse woody debris. It appears to be one of the few truffles that tolerates serpentine soils. It is known from only 6 collections since being described in 1898.

B. Past Actions.

C. Species Range. Endemic to central Sierra Nevada Mountains of California north

to Yamhill County, Oregon

D. Non-habitat Factors. Associated with lowland, xeric forests. Most of the suitable habitat of *Balsamia nigrens* has been developed for housing, used for grazing, logged or otherwise been drastically disturbed or altered.

E. Inadequate Information. The widely disjunct localities suggest that populations may occur, or at least may have occurred prior to disturbance, over much of the forest fringe of the California central valleys north to the Willamette Valley. These forest types have been little sampled for truffles.

F. Features of the Alternative. Most of the suitable habitat for *Balsamia nigrens* is likely to occur in the matrix.

V. Cumulative Effects Assessment. Only 1 of the 3 known localities of this species in the range of the northern spotted owl is on federal land; the other 2 are on private land.

VI. Summary. This species is endemic from the Sierras of central California north to the Willamette Valley of Oregon, and occurs on habitats that for the most part have been severely disturbed or altered. Rating reflects rarity and natural history of the species plus concern for loss of its habitat, which for the most part has been severely disturbed, and occurs in the matrix or on non-federal land.

VII. Mitigation. Protect the known locality on federal land (BLM and Siskiyou National Forest), and consider establishment of Mycological Special Interest Area. Survey suitable habitat in low-elevation pine-oak stands (mature or with a legacy of coarse woody debris) to determine extent of populations.

A. Geographic Extent. Associated with lowland, xeric forests, central Sierra Nevada Mountains north to Yamhill County, Oregon.

B. Specific Habitats. Waldo Hill, Josephine County, Oregon, BLM and Siskiyou National Forest (T 40 S., R 5 E., Sec. 33, SW 1/4 and T 41 S., R 5 E., Sec. 4, NW 1/4); North Shore Applegate River Road, Ramsgate Ranch, Josephine County, Oregon (private land); Yamhill River, Flying M Ranch, Yamhill County, Oregon.

C. Mitigation Measures. Inventory the Waldo Hill locality, the nearby Eight-Dollar Mountain Botanical Area and similar habitats in the area to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of populations. Consider establishment of Mycological Special Interest Area at Waldo Hill. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the single known locality on federal land in the range of the northern spotted owl will reduce risk of extirpation of the species in that range.

I. **Species.** Rare Truffle (*Choiromyces venosus*)

II. **FEMAT Rating.** 0-18-60-23
(collective rating for Rare Truffle group)

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** This large truffle is widely distributed in Europe as a broad-ranging ectomycorrhizal fungus with both conifers and deciduous trees. Despite extensive collecting for truffles in North America, it has been found only once at a locality in Oregon in a mature Douglas-fir stand.

B. **Past Actions.**

C. **Species Range.** Widespread in Europe; in North America known only from a single large specimen collected in the BLM Mohawk Research Natural Area east of Springfield (T 16 S., R 2 W., Sec. 29).

D. **Non-habitat Factors.** The locality is a relatively low-elevation section surrounded by non-federal land that has been extensively logged. Effects on the edge of its distribution are unknown.

E. **Inadequate Information.** The novelty of a single North American occurrence of a species widely distributed in Europe is impossible to explain at the present level of knowledge. Careful survey of the area to establish better data on extent of its occurrence in the Mohawk RNA and adjacent lands is necessary.

F. **Features of the Alternatives.**

V. **Cumulative Effects Assessment.** Assuming that this truffle has (or had) a wider distribution than is currently known, the clearcutting of both BLM and private lands in the area has probably restricted the population.

VI. **Summary.** The species is extremely rare in North America, having been found in a mature Douglas-fir stand in an area that has been subjected to extensive logging.

VII. **Mitigation.** Complete protection of the collection locality and unlogged stands in the vicinity is needed to prevent extirpation of the species.

A. **Geographic Extent.** In North America known only from a single large specimen collected in the BLM Mohawk Research Natural Area.

B. **Specific Habitats.** BLM Mohawk Research Natural Area east of Springfield.

C. **Mitigation Measures.** Protection of known population and suitable habitat in

Mohawk RNA and adjacent unlogged areas will provide protection for this species. Conduct surveys to identify additional areas of suitable habitat and populations. Establish buffer around known locations to provide for adequate protection of population. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Complete protection as indicated above may prevent extirpation of this species from North America.

I. Species. Rare Truffle (*Elaphomyces anthracinus*)

II. FEMAT Rating. 0-18-60-23
(collective rating for Rare Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare but widely distributed truffle is known from less than 50 collections since it was described from Italy in 1832. It has been found only once in the range of the northern spotted owl in a mature ponderosa pine stand and is a probable ectomycorrhizal associate of pines as well as a wide variety of other ectomycorrhizal hosts. Its mycelium may be widely distributed in soil, but evidently it fruits only in certain habitats.

B. Past Actions.

C. Species Range. Western Europe, eastern United States; Riverside Campground, Deschutes National Forest.

D. Non-habitat Factors. The Oregon locality is in a heavily used recreation area.

E. Inadequate Information. Fruiting of this species occurs only in very restricted habitats for reasons unknown.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. The single known locality is on federal land, but similar habitats occur on nearby private lands. Much similar habitat and potentially suitable habitat has been extensively logged.

VI. Summary. This rare species fruits only in specific habitats. Rating reflects its rarity and natural history more than features of the alternatives.

VII. Mitigation. Inventory area of the single, known locality in Oregon for populations; designate appropriate areas outside developed campgrounds as a Mycological Special Interest Area to protect the population.

A. Geographic Extent. Western Europe, eastern North America, and east-side Oregon Cascades.

B. Specific Habitats. Mature ponderosa pine forest, Riverside Campground, Deschutes National Forest, T 13 S., R 9 E., Sec. 15, E. 1/2.

C. Mitigation Measures. Initially designate 160 acres of similar habitat around the known location of the species until ground survey can be conducted to determine extent of the population. Survey general area of Riverside Campground and adjacent suitable habitat to identify additional populations. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of special interest area to protect known populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of the habitat of the single known location in Oregon will reduce risk of extirpation within the range of the northern spotted owl.

I. Species. Rare Truffle (*Elaphomyces subviscidus*)

II. FEMAT Rating. 0-18-60-23
(collective rating for Rare Truffle group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare fungus is an ectomycorrhizal associate with mature to old-growth pines and probably other Pinaceae at mid-elevations.

B. Past Actions.

C. Species Range. Oregon Cascade Mountains, near Prospect, Rogue River National Forest T 32 S., R 3 E., Sec. 29, N. 1/2 (type locality), and Three Creeks Lake, Deschutes National Forest, T 17 S., R 9 E., Sec. 14, SW 1/4; an additional collection has been recorded from Arizona. Known only from these three collections.

D. Non-habitat Factors. Both Oregon locations are in heavily used recreation areas and hence subject to soil compaction from trampling. The Prospect area has been

extensively logged.

E. Inadequate Information. The widely disjunct known locations (Arizona and Oregon) suggest a broader distribution in pine forests than now known. Extensive collecting over past decades in such forests, however, suggests that it is indeed rare.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. Both known locations are on federal land; the habitat of the type locality, however, includes extensive private lands in the vicinity.

VI. Summary. Habitats of this rare fungus probably lie mostly in areas subjected to heavy recreational use or timber harvest.

VII. Mitigation. Inventory type locality and Three Creeks Lake locality to determine extent of local populations and establish a special interest area to protect the type locality.

A. Geographic Extent. Central to southern Oregon Cascades; Arizona

B. Specific Habitats. (see Species Range)

C. Mitigation Measures. Initially designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Establish Mycological Special Interest Area to protect type locality. Inventory Three Creeks Lake locality to identify additional populations. Monitor recreation impacts at Three Creeks Lake. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protecting the type locality and additional known populations will reduce risk of extirpation.

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- I. **Species. Rare Chanterelle** (*Cantharellus formosus*)
(general comments about *Cantharellus cibarius*, *C. subalbidus*, *C. tubaeformis*)
- II. **FEMAT Rating.** 10-33-38-13
(collective rating for the Rare Chanterelle group)
- III. **Modifications due to changes in Alternative 9.** Removal of the 180-year rotation in the matrix areas in California may reduce available and potential habitat for this species. Management of matrix areas will influence the distribution, frequency, reproduction and productivity of these species.
- IV. **Explanation of Rating.**
- A. **Natural History.** Ectomycorrhizal and reported from a variety of conifer and mixed forests in northern California, Oregon and Washington. Fruits during the summer, fall and winter seasons depending on site and geographical location. *Cantharellus tubaeformis* is frequently associated with decaying coarse woody debris and can be a major species in late-successional forests.
- B. **Past Actions.** This is unknown for certain but could be a factor for populations that occur in late-successional forests. Past forest management practices have influenced growth, reproduction and distributions of chanterelles.
- C. **Species Range.** Throughout northern California, Oregon and Washington on both federal and non-federal lands where suitable habitats are found.
- D. **Non-habitat Factors.** These species of chanterelles are regularly harvested commercially and by amateur collectors for food. Harvesting could have long term effects on distribution, frequency, reproduction and productivity as well as genetic variability. Poor air quality may cause a decline in these species as shown for chanterelles and other ectomycorrhizal fungi in certain parts of Europe. The effects of climate change are unknown.
- E. **Inadequate Information.** In general this is a well known group of mushrooms. However, there is still debate over the identification of species in the Pacific Northwest. According to chanterelle experts, our common chanterelle is not *Cantharellus cibarius*, but could be more related to or the same as *C. formosus*. The general distribution and ecology for these species are known but details are lacking. Long term studies of productivity, reproduction and evaluation of genetic variability within and between populations from different habitats are needed to evaluate the effects of harvesting, forest management practices and environmental factors on these species.

F. Features of the Alternative. The primary features of the alternatives which affected the rating were the overall acreage of late-successional reserves, their distribution, location and management, as well as management in the matrix. Factors affecting management of matrix lands are important because some of these species enter forest ecosystems in the early stages of succession.

V. Cumulative Effects Assessment. An accurate assessment of cumulative effects cannot be made in relation to late-successional forests. Forest management practices and harvesting are important factors but are difficult to accurately evaluate. Air pollution has been shown to cause a decline in ectomycorrhizal fungi in Europe and certainly could be a factor here. The effects of global climate change cannot be determined.

VI. Summary. The original rating reflected the consensus at the time that *Cantharellus formosus* was rare to uncommon or found only in localized areas. This does not now appear to be the case, therefore the rating is not accurate. The species does not appear to be at greater risk than any other species of commercially harvested chanterelle. Commercial harvesting and environmental conditions, e.g., air quality, clearly could impact all species of chanterelles. This should be of concern on both federal and non-federal lands. Basic work on the classification of this species and its relationship to other chanterelles in the region should be done in conjunction with other studies.

VII. Mitigation. Mitigation will improve knowledge of species and determine effects of forest management and commercial harvesting on their distributions, frequency and abundance (productivity) as well as their biology and general ecology.

A. Geographic Extent. Throughout northern California, Oregon and Washington on both federal and non-federal lands where suitable habitats are found.

B. Specific Habitats. Reported from a variety of conifer and mixed forests.

C. Mitigation Measures. An effort should be made to determine the relationship of *Cantharellus formosus* to other species of chanterelles in the region. Survey and inventory all chanterelles to develop accurate distribution maps, determine frequency and abundance (productivity), and establish habitat requirements. Commercial harvesting of these species should be monitored. This will help to establish baseline data necessary to evaluate the effects of harvesting as well as changes in environmental conditions. *Cantharellus tubaeformis* is more characteristic of late-successional forests and often is closely associated with decaying coarse woody debris. It should be closely monitored in such ecosystems, particularly if harvested for food.

D. Benefits. Mitigation will provide baseline information that can be used to evaluate short and long term effects of harvesting and forest management practices on the distribution, growth and reproduction of chanterelles. Such data will also be valuable for determining the impact of air pollution and global climate change on chanterelles.

I. Species. Rare Chanterelle (*Polyozellus multiplex* (Blue/Black Chanterelle))

II. FEMAT Rating. 22-43-27-8

III. Modifications Due to Changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Rare in the Pacific Northwest ; occurs in montane areas, typically in the course of intermittent streams. Species is mycorrhizal with spruce and true fir. Commercial harvest is limited, but fruiting bodies bring a high price.

B. Past Actions. Not a factor.

C. Species Range. Widespread (Maine, New Hampshire, New Mexico) but rare except Rockies. Occurs primarily just east of Cascade crest in the Pacific Northwest .

D. Non-habitat Factors. Some commercial harvest, marketed fresh to upscale chefs. Potentially affected by atmospheric pollution. Potential global warming may move range northward.

E. Inadequate Information. Distribution and specific locations in this region are not well known. Information is needed on reproductive biology and factors which limit establishment of the species in this region compared to the Rocky Mountains.

F. Features of the Alternative. Primary feature is adequate protection of seeps and headwaters of smallest streams in montane conifer stands with mature spruce and true fir.

V. Cumulative Effects Assessment. Repeated harvest of fruiting bodies at a few limited sites might be a problem through reduction of inoculum and even trampling of site. Occurs mostly on federal lands.

VI. Summary. Rating based on scarcity in this region, and uncertainty about effects of harvest, or atmospheric and climatic changes.

VII. Mitigation. Mitigation may improve rating.

A. Geographic Extent. Northern Sierras, Oregon, Washington Cascades.

B. Specific Habitats. Montane spruce/fir forests, chiefly in edge of seeps or along intermittent streams.

C. Mitigation Measures. Survey to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Monitor known populations and develop management guidelines to protect populations from adverse impacts, particularly commercial harvest. Develop and maintain interagency GIS layer

and associated database for locations of rare or locally endemic taxa. Adequate buffers on intermittent streams and seeps are important for this species.

D. Benefits. Mitigation may improve the rating. Protection of known populations will reduce risk of extirpation.

I. Species. Chanterelles - Gomphus

(*Gomphus bonarii*)
(*Gomphus clavatus*)
(*Gomphus floccosus*)
(*Gomphus kauffmanii*)

II. FEMAT Rating. 57-22-18-3
(collective rating for Chanterelle - Gomphus group)

III. Modifications Due to Changes in Alternative 9. These species occupy mature, late-successional conifer forests and are probably more abundant in northern California than elsewhere in the range of the northern spotted owl. Consequently, a decrease in rotation length in northern California will reduce current and potential habitat, and implies a revision of the rating downward for these species.

IV. Explanation of Rating.

A. Natural History. *Gomphus clavatus* is uncommon to rare, but sometimes fruits abundantly in a limited area. It is edible and sought for that reason, but not marketed commercially. *Gomphus floccosus* is more common and widespread, with two near relatives *G. bonarii* and *G. kauffmanii*. All three are edible for some people, poisonous for others. Therefore, none are likely to become commercial species, despite a resemblance to chanterelles. All four species are mycorrhizal and associated with mature to old late-successional conifer forests in the west.

B. Past Actions. Past clearcutting of old conifer stands has eradicated populations of all species.

C. Species Range. Rocky Mountains and westward. *Gomphus floccosus* also occurs with hemlocks in older forests in eastern North America.

D. Non-habitat Factors.

E. Inadequate Information. Taxonomic relationships unknown, such as how many species are in *floccosus* group. How early in succession can species become established?

F. Features of the Alternative. Key factor is availability and a well-distributed network

of late-successional conifer stands (>200 years old).

V. **Cumulative Effects Assessment.** Species are well represented on federal lands, thus not dependent for survival on non-federal sites. It seems unlikely that these species will establish on sites continuously harvested at 80-100 years. Survival in matrix may depend on management of leave trees.

VI. **Summary.** Rating reflects known distribution and uncertainty about availability of older late-successional forests.

VII. **Mitigation.** Mitigation might improve ratings. Probably need to identify and protect habitats, rather than specific sites for these species. This genus is easily identified in the field and therefore should be a key genus in surveys of late successional conifer stands.

A. **Geographic Extent.** Throughout region, especially northern California.

B. **Specific Habitats.** Late-successional conifer forests.

C. **Mitigation Measures.** Retain 180-year rotation in northern California, particularly in relation to known populations. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations. For rarer species or localized populations, provide buffer zones which will maintain integrity of the habitat and microclimate. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance. Conduct taxonomic studies to determine status of less common species.

D. **Benefits.** Mitigation is likely to improve rating. It will provide baseline data on the species from which we can determine the effects of forest management practices on their distribution, frequency, habitat requirements, general ecology and reproduction.

I. **Species. Coral Fungi - *Ramaria* spp.**

Uncommon Ramarias (13 spp.)

(*Ramaria abietina*)
(*R. araiospora**)
(*R. botrytis* var. *aurantiiramosa**)
(*R. concolor* f. *tsugina* (on wood))
(*R. coulterae*)
(*R. fasciculata* var. *sparsiramosa**)
(*R. gelatiniaurantia**)
(*R. largentii**)

Rare Ramarias (15 spp.)

(*Ramaria amyloidea**)
(*R. aurantiisiccescens**)
(*R. celerivirescens**)
(*R. claviramulata**)
(*R. concolor* f. *marri* (on wood))
(*R. cyaneigranosa**)
(*R. hilaris* var. *olympiana**)
(*R. lorithamnus*)

(<i>R. rubella</i> var. <i>blanda</i> * (on wood))	(<i>R. maculatipes</i> *)
(<i>R. rubrievanescens</i> *)	(<i>R. rainierensis</i> *)
(<i>R. rubripermanens</i> *)	(<i>R. rubribrunnescens</i> *)
(<i>R. suecica</i>)	(<i>R. stuntzii</i> *)
(<i>R. thiersii</i> *)	(<i>R. verlotensis</i> *)
	(<i>R. gracilis</i> (in Pacific Northwest))
	(<i>R. spinulosa</i> (in Pacific Northwest))

II. FEMAT Rating. 55-20-18-8
(collective rating for Coral Fungi group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of these species and impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. These species are closely associated with late-successional forests. Many of the litter/humus dwelling species are assumed to form ectomycorrhizae with forest trees; the biology of wood inhabiting species is uncertain. Many species are associated with western hemlock, they also occur with *Abies*, *Pinus*, *Picea* and *Pseudotsuga*, and perhaps *Taxus*. They fruit primarily in the late summer and fall seasons; however some species fruit in the spring and others in the winter, depending on site and geographic location.

B. Past Action. Habitat for these species has been reduced by logging, especially low to mid-elevation forests.

C. Species Range. Ramarias occur throughout northern California, Oregon and Washington, however, the overall distribution of individual species is unknown. Some species may be endemic to the Pacific Northwest or to certain sites within this region. All species with the type locality in California, Oregon or Washington are marked with an *. There is a large percentage of west coast species

D. Non-habitat Factors. Some of these species are harvested for food, but not extensively. Whether or not harvesting impacts these species is unknown. Air pollution could cause a decline in species, especially those that are ectomycorrhizal. Effects due to global climate change are uncertain.

E. Inadequate Information. The taxonomy of this group is currently being reviewed by Currie Marr. Overall distributions are unknown. Further information on frequency, reproduction, habitat requirements, and general ecology is needed for all species. The actual extent to which they are harvested for food should be determined. Species-specific information was not available at the time of the FEMAT rating. Information on the genus *Ramaria* has since been provided by Currie Marr, a Coral specialist, SUNY, Oneonta, New York. He listed 27 species as common which were not addressed here.

F. Features of Alternatives. Overall acreage and distribution of late-successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species. Management of matrix areas is important for developing future habitats in which they can grow. Quality of habitat and management of the matrix are important since we are unsure as to when these fungi appear in conifer ecosystems (what stage of succession) and the ecological parameters that allow them to do so.

V. Cumulative Effects Assessment. Accurate assessment cannot be made with current knowledge of species, however, populations of certain species are known to occur only in old-growth forest reserves or national parks. This may provide evidence that these species are more restricted in distribution now than in the past. The potential negative effects of air pollution may be predicted based on data from European forest ecosystems. The effects of climatic change cannot be predicted.

VI. Summary. Ratings reflect lack of knowledge of this unique group of fungi, including information on distribution, frequency, habitat requirements, general ecology and reproduction. Uncertainties about the long term effects of forest management practices and environmental conditions also contributed strongly to the ratings.

VII. Mitigation. Mitigation is likely to improve ratings at least for some species. It will preserve known populations and type localities, determine overall distribution for species, and provide baseline information on the frequency, habitat requirements and general ecology of the species.

A. Geographic Extent. Northern California, Oregon and Washington. Some species may be endemic to the Pacific Northwest or to certain sites within this region. All species with the type locality in California, Oregon or Washington are marked with an *.

B. Specific Habitats. These species are closely associated with late-successional forests. Many species occur with western hemlock, however, they are also associated with *Abies*, *Pinus*, *Picea* and *Pseudotsuga*, and perhaps *Taxus*. Many of the litter/humus dwelling species are assumed to form ectomycorrhizae with forest trees; the biology of wood inhabiting species is uncertain.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Protect known locations of rare species and type localities by establishing adequate buffers around populations to maintain integrity of habitat and microclimate of the site. Consider establishment of Mycological Special Interest Areas to protect type localities. Develop management guidelines to protect populations from adverse impacts. Develop interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Determine whether non-federal lands are important for connectivity between populations of species, or to provide site protection for species, especially those that occur in coastal forests. Matrix areas adjacent to known populations should be managed

toward establishing late-successional forest habitats. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Protection of known populations of the rare species will reduce risk of extirpation. Survey will provide baseline data for the listed species from which we can determine the effects of forest management practices on their distributions, frequency, biology and reproduction. Mitigation should reduce the number of isolated populations across the landscape.

I. Species. *Phaeocollybia*

<i>(Phaeocollybia attenuata)</i>	<i>(Phaeocollybia olivacea)</i>
<i>(Phaeocollybia californica)</i>	<i>(Phaeocollybia oregonensis)</i>
<i>(Phaeocollybia carmanahensis)</i>	<i>(Phaeocollybia piceae)</i>
<i>(Phaeocollybia dissiliens)</i>	<i>(Phaeocollybia pseudofestiva)</i>
<i>(Phaeocollybia fallax)</i>	<i>(Phaeocollybia scatesiae)</i>
<i>(Phaeocollybia gregaria)</i>	<i>(Phaeocollybia sipei)</i>
<i>(Phaeocollybia kauffmanii)</i>	<i>(Phaeocollybia spadicea)</i>
(and additional new species)	

II. FEMAT Rating. 45-38-12-5
(collective rating for *Phaeocollybia* group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of these species and impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. Possibly ectomycorrhizal (currently under investigation). Low elevation to montane late-successional forests, typically prefer moist habitats. Fruiting bodies are produced in the late summer, fall and winter depending on geographic location.

B. Past Actions. Unknown for certain, however, logging in low elevation forests over past decades has removed extensive habitat for these species.

C. Species Range. In general the genus occurs from British Columbia to northern California. Some species are distributed throughout this region, others appear to have more restricted distributions. It appears that all listed species are endemic to the Pacific Northwest. Distribution and frequency are currently under study.

D. Non-habitat Factors. Poor air quality could cause decline of these species as it has

for certain ectomycorrhizal fungi in Europe.

E. Inadequate Information. The genus is currently under investigation by Lorelei Norvell, University of Washington. Therefore, improved knowledge of the number of species and their distributions and ecology is forthcoming.

F. Features of Alternatives. Overall acreage and distribution of late-successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species. Management for a well-distributed network of late-successional forests in the coastal areas of California, Oregon and Washington are necessary to maintain connectivity between populations of species.

V. Cumulative Effects of Assessment. Accurate assessment is uncertain at this time. However, it is likely that logging in coastal areas has fragmented and perhaps isolated certain populations. Forest management on non-federal lands, for example in southwestern Washington, could relate to the frequency and distribution of certain species in the future. The potential effects of global warming cannot be predicted, however, air pollution may cause a decline in the species. Connectivity in low elevation late-successional forest stands would reduce the likelihood of isolating or losing certain populations.

VI. Summary. Ratings reflect concern that much of the habitat for these species has been removed by logging coastal late-successional forests. Also, the number of species of *Phaeocollybia* in the Pacific Northwest is larger than for any similar size area in the world and it appears that most of the species that occur here are endemics. The genus is very characteristic of late-successional forests, including ancient stands, especially at lower elevations.

VII. Mitigation. Mitigation will preserve known populations and allow for a comprehensive mapping of all species within the range of northern spotted owl. It will also provide improved continuity between populations of species in coastal forests. Long term monitoring of the species will help to evaluate the long term health of late-successional low elevation forests.

A. Geographic Extent. In general, these species occur from British Columbia to northern California. Some species occur throughout this region, others are more restricted in their distribution.

B. Specific Habitat. Low elevation to montane coniferous forest but most prevalent at low elevations. Prefers moist, well-developed late-successional forest habitats.

C. Mitigation Measures. Include these species in the general regional inventory for fungi, to develop information on distribution, abundance, habitat requirements and ecology. Determine the distribution of populations relative to late-successional reserves and matrix allocation. Protect known populations of rare species and type localities by providing a buffer that is adequate to maintain integrity of habitat and microclimatic conditions. Consider establishment of Mycological Special Interest Areas to protect type localities of species. Develop a GIS layer and associated database for locations of populations. Provide for connectivity of populations by managing for late-successional

habitat adjacent to known populations, particularly in low elevation and coastal areas. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Mitigation should improve the ratings, especially for the more frequent and widely distributed species. It will lower the risk of extirpation of isolated populations as well as prevent further isolation of existing populations. Development of late-successional forest on both non-federal and federal lands in coastal areas would provide better connectivity of species.

I. Species. Uncommon Gilled Mushrooms - Ectomycorrhizal

(<i>Catathelasma ventricosum</i>)	(<i>Cortinarius valgis</i>)
(<i>Cortinarius azureus</i>)	(<i>Dermocybe humboldtensis</i> *)
(<i>Cortinarius boulderensis</i> *)	(<i>Hebeloma olympiana</i> *)
(<i>Cortinarius cyanites</i>)	(<i>Hygrophorus caeruleus</i> *)
(<i>Cortinarius magnivelatus</i> *)	(<i>Hygrophorus karstenii</i>)
(<i>Cortinarius olympianus</i> *)	(<i>Hygrophorus vernalis</i> *)
(<i>Cortinarius spilomeus</i>)	(<i>Russula mustelina</i>)
(<i>Cortinarius tabularis</i>)	

II. FEMAT Rating. 5-50-28-18

(collective rating for Uncommon Gilled Mushroom - Ectomycorrhizal group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of these species and may impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. These species represent a number of uncommon ectomycorrhizal species that occur in low elevation to montane coniferous ecosystems. Some of them, such as *Cortinarius magnivelatus* and *Hygrophorus caeruleus*, appear to occur primarily in montane ecosystems while others, for example, *Dermocybe humboldtensis*, are more characteristic of low elevation forests. The range in tree hosts for these species is unknown, so far none seem to be restricted to a single tree host. Most produce fruit bodies in the late summer and fall seasons, however, *Hygrophorus vernalis*, *Hygrophorus caeruleus* and *Cortinarius magnivelatus* typically fruit earlier in the year. The latter is a hypogeous species and likely is dispersed at least in part by animals.

B. Past Actions. Unknown. However, where these species occur in low elevation forests much of their natural habitat and range has probably been destroyed or

modified by logging.

C. Species Range. The distribution and range of individual species is not completely known. Those marked with an * above are likely endemic to the Pacific Northwest or western North America.

D. Non-habitat Factors. Poor air quality may cause a decline of these ectomycorrhizal species, as this has been documented in some European forests.

E. Inadequate information. The distribution, frequency and ecology of these species requires extensive study. They represent the "tip of the iceberg", as there are a large number of ectomycorrhizal species that fall into this category of uncommon gilled mushrooms.

F. Features of Alternatives. Overall acreage and distribution of late-successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species.

V. Cumulative Effects Assessment. Accurate assessment cannot be made with current knowledge of species, however, populations of certain species are known to occur only in old-growth forest reserves or national parks. It is possible these species may currently be more restricted in distribution than in the past. The potential negative effects of air pollution may be predicted based on data from European forest ecosystems. The effects of potential climate change cannot be predicted.

VI. Summary. Ratings reflect lack of knowledge of these uncommon ectomycorrhizal species and uncertainties about the long term effects of management practices and environmental conditions, *i.e.*, air pollution.

VII. Mitigation. Mitigation can improve ratings of these species. It will preserve known populations and determine where additional populations of these species occur within the range of the northern spotted owl.

A. Geographic Extent. The distribution and range of individual species is not completely known. Those species marked with an * are likely endemic to the Pacific Northwest or western North America.

B. Specific Habitats. Details of habitat requirements are poorly known. In general these species occur only in late-successional forest ecosystems, certain species are primarily montane, some are more frequent in low elevation forests, and others occur in both regions.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Focus on montane and low elevation forests for this species group. Develop database of known locations and determine if management is necessary to protect known populations. For rarer species or localized populations, provide buffer zones

which will maintain integrity of the habitat and microclimate. Low elevation and montane late-successional ecosystems should be maintained in relation to known populations. Quality of habitat and management of matrix are important since we are unsure as to when these fungi appear in conifer ecosystems (what stage of succession) and the ecological parameters that allow them to do so. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance. In the case of *Cortinarius magnivelatus*, a hypogeous species, quality of habitat may be particularly important since it is likely that it is at least in part dispersed by animals.

D. Benefits. Mitigation will provide baseline data on the listed species from which we can determine the effects of forest management practices on their distribution, frequency, habitat requirements, general ecology and reproduction. Mitigation should prevent extirpation of species and reduce the number of isolated populations across the landscape.

I. Species. Rare Gilled Mushrooms - Ectomycorrhizal

(*Cortinarius canabarpa* (syn. *C. umidicola*))

(*Cortinarius rainierensis*)

(*Cortinarius variipes*)

(*Tricholoma venenatum*)

II. FEMAT Rating. 0-2-83-15

(collective rating for Rare Gilled Mushroom - Ectomycorrhizal group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Mycorrhizal, late-successional conifer forests, range of host species is not known for certain. Species are considered rare, with only one or a few known collections. *Cortinarius rainierensis* was described from the Pacific Northwest, however, efforts to find it over the past decade have been unsuccessful. It may or may not be endemic. The remaining three species are not endemic. All require diverse older forests with a heavy litter/humus layer and associated coarse woody debris. Fruiting bodies may occur annually in the same location or only occur sporadically in a given location. Fruit in late summer and fall.

B. Past Actions. Unknown for certain, however, any perturbation of late-successional forests, e.g., logging, may influence present day distributions, especially in mid to low elevation forests.

C. Species Range. There are few records of these species and therefore their distributions are unknown for all lands.

D. Non-habitat Factors. Air pollution could cause the decline of these species as shown for ectomycorrhizal fungi in Europe.

E. Inadequate Information. Overall distribution and ecology are poorly known.

F. Features of Alternatives. The primary features of the alternatives which affected the rating were the overall acreage of late-successional reserves, their distribution, location and management, as well as management of matrix lands. Late-successional forests with well-developed humus/litter are likely critical to their growth, reproduction and survival. Quality of habitat in reserves and matrix are important since we are unsure of how and when these species become part of the forest ecosystem.

V. Cumulative Effects Assessment. Assessment can not be made with current knowledge of these species. Effects of air pollution and global warming are unknown.

VI. Summary. Ratings reflect rareness of species and poor knowledge of their distribution, frequency, habitat requirements, general ecology and reproduction. Long term effects of environmental conditions are uncertain, however, air pollution could cause decline of these species. Forest management practices in early successional stands may influence the occurrence of these species in late-successional forests.

VII. Mitigation. Mitigation may improve ratings. It will preserve the known populations and determine the overall distribution of each species within the range of the northern spotted owl, as well as providing baseline information.

A. Geographic Extent. The overall distribution of each species is unknown on all lands. All are known from either one or a few sites.

B. Specific Habitats. Late-successional conifer forests with well developed humus/litter layers and associated woody debris. No specific hosts are known, however, a mixture of ectomycorrhizal host trees could be beneficial.

C. Mitigation Measures. Identify known locations of these species, and manage to protect these populations. Survey suitable habitat in adjacent areas to locate additional populations. Develop GIS layer and associated database to track rare and locally endemic species. Include these species in the general mycological survey for the region, to develop information on the distribution of populations relative to various land allocations, ecological requirements such as the range of tree hosts, habitat, edaphic factors, associated fungi, and successional role. Map and monitor known populations of each species. Survey of non-federal lands could become important in terms of connectivity of populations in certain geographical areas, *e.g.*, coastal forests. For known populations provide an adequate buffer zone to maintain the integrity of the habitat and microclimate. Forest management practices in relation to known localities for these species should maintain diverse late-successional forest habitats.

D. Benefits. Mitigation will likely improve ratings, and will reduce risk of extirpation of known populations. It will also provide baseline information for each species, which can be used in long term monitoring to determine effects on species viability.

I. **Species.** Rare Gilled Mushrooms - Ectomycorrhizal
(*Cortinarius verrucisporus*, *Cortinarius wiebeae*)

II. **FEMAT rating.** 0-2-83-15
(collective rating for Rare Gilled Mushrooms - Ectomycorrhizal group)

III. **Modifications due to changes in Alternative 9.** Removal of the 180-year rotation in matrix areas of California may reduce available habitat for *Cortinarius verrucisporus*, and may affect the survival and distribution of this species.

III. **Explanation of Rating.**

A. **Natural History.** Ectomycorrhizal, montane late-successional forests, often at relatively high elevations. Associated with true firs and other conifers. They are grouped together here because they represent a small group of species sometimes called hypogeous Cortinari. Fruit during the late spring and summer. They are likely dispersed at least in part by mammals.

B. **Past Actions.** Unknown for certain, however, past logging may have affected their overall distributions.

C. **Species Range.** *Cortinarius wiebeae* is known only from Camas Corral, Mt. Hood National Forest, while *C. verrucisporus*, which was described from Amador County, California, is more widely distributed, occurring in Oregon as well as in California.

D. **Non-habitat Factors.** Poor air quality could cause decline of these species since they are ectomycorrhizal. The decline of ectomycorrhizal fungi has been documented in certain European forests.

E. **Inadequate Information.** General distributions are known but overall distribution, frequency, habitat requirements, general ecology and reproduction are poorly understood.

F. **Features of Alternative.** The distribution and amount of late-successional forests, as well as management of the late-successional reserves were important factors in the ratings of these species. Particularly important are maintenance of late-succession montane forests in relation to known populations. Quality of habitat may be particularly important since these species, at least in part, are dispersed by mammals.

V. **Cumulative Effects Assessment.** Assessment cannot be made with current knowledge of species. Effects of air pollution and global climate change are unknown for certain, however, evidence from European forests indicate that air pollution can cause a decline in ectomycorrhizal fungi.

VI. **Summary.** Ratings reflect rareness of species *C. wiebeae*, which is known only from the type locality. There is poor understanding of the distribution, frequency, habitat requirement, general ecology and reproduction of these species. Long term effects of environmental conditions are uncertain, however, air pollution could cause decline of these species. Forest management practices in early successional stands could influence the occurrence of these species in late-successional forests.

VII. **Mitigation.** Mitigation will improve ratings. It will protect known populations and determine if there are additional populations within the range of the northern spotted owl. It will also provide baseline information on frequency, habitat requirements, general ecology and reproduction.

A. **Geographic Extent.** *Cortinarius wiebeae* is known only from the type locality, *Cortinarius verrucisporus* is more widely distributed in California and also occurs in Oregon.

B. **Specific Habitats.** Occurs in montane late-successional forests at relatively high elevations. Details of habitat requirements are poorly known.

C. **Mitigation Measures.** Establish Mycological Special Interest Area to provide protection for the type locality (the only known location) of *Cortinarius wiebeae*. Survey suitable habitat in the vicinity to locate additional populations. Develop GIS layer and associated database to track rare and locally endemic species. Include these species in the general mycological survey for the region, including survey and inventory of all montane reserves and matrix areas, to develop information on their distribution, abundance, habitat requirements and ecology. Map and monitor known populations and determine how animals, particularly mammals, are involved in dispersal and distribution of the species. Since these species occur in drier montane forests, their occurrence on the east side of the Cascades needs investigation. Most known populations are on federal lands, therefore, non-federal lands could become important in terms of connectivity of species in montane forests. Forest management practices in relation to known localities for these species should maintain intact late-successional forests. Matrix management practices such as providing for coarse woody debris, aggregated leave tree retention, and minimizing site disturbance may benefit these species.

D. **Benefits.** Mitigation will reduce the risk of extirpation for *Cortinarius wiebeae*, and will likely improve the rating for *Cortinarius verrucisporus*. In addition, it will provide baseline data on their distribution, frequency, habitat requirements, general ecology and reproduction. This information will help evaluate the effects of forest management practices, air pollution and other factors on populations of these species.

I. **Species.**
Uncommon Ecto-Polypores

(*Albatrellus ellisii*)
(*Albatrellus flettii*)
Rare Ecto-Polypores
(*Albatrellus avellaneus*)
(*Albatrellus caeruleoporus*)

II. FEMAT Rating.

42-32-20-7 (collective rating for Uncommon Ecto-Polypore group)
2-42-38-18 (collective rating for Rare Ecto-Polypore group)

III. Modifications due to changes in Alternative 9. Eighty year rotations will not provide habitat for these species.

IV. Explanation of Rating.

A. Natural History. Mycorrhizal polypores. Sometimes collected for food, but rarely harvested commercially. Very scattered populations, but may appear common due to heavy fruiting of single populations. Chiefly, but not entirely, coastal in this region. Occurs primarily or exclusively in old-growth, but commonly with mixed hardwoods.

B. Past Actions. Harvest of coastal forests has undoubtedly eradicated many, maybe most, populations.

C. Species Range. Washington, Oregon, northern California; Rocky Mountains, northeastern United States; Europe.

A. caeruleoporus is known from only one site on the Olympic Peninsula, but is more common in the northeastern United States.

D. Non-habitat Factors.

E. Inadequate Information. Reproductive biology, extent and lifespan of single mycelia/populations, mycorrhizal associates and taxonomy is not well known.

F. Features of the Alternative. Primary concern is status and protection of coastal late successional forests.

V. Cumulative Effects Assessment. Many sites are on coastal non-federal land, especially state parks. Management of these sites may be crucial to survival.

VI. Summary. Ratings reflect scarcity and uncertainty of future status of suitable habitat.

A. Geographic Extent. Pacific Northwest and northern California, especially coastal old-growth.

B. Specific Habitats. Old-growth conifer stands in Oregon and Washington, and mixed coastal conifers and hardwoods in California.

C. Mitigation Measures. These species should be key species in surveys of coastal

forests. For the two rare species, survey known sites to delineate boundaries of habitat and populations, establish buffer around known locations to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa.

Include all species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Focus on coastal low elevation forests for this species group. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations. For rarer species or localized populations, provide buffer zones which will maintain integrity of the habitat and microclimate. Low elevation late-successional coastal forests should be maintained in relation to known populations. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance. Encourage long term rotations to replace coastal old-growth to provide potential habitat for these species.

D. Benefits. Mitigation may improve rating for these species. Survey will provide baseline data on the species from which we can determine the effects of forest management practices on their distribution, frequency, habitat requirements, general ecology and reproduction. Mitigation should reduce risk of extirpation of the rare species and reduce the number of isolated populations across the landscape.

I. Species. Tooth Fungi

(*Hydnum repandum*)
(*Hydnum umbilicatum*)
(*Phellodon atratum*)
(*Sarcodon fuscoindicum*)
(*Sarcodon imbricatus*)

II. FEMAT Rating. 67-27-7-0
(collective rating for Tooth Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. These tooth fungi are mycorrhizal with both conifers and hardwoods. Although they occur in older late-successional forests they re-enter second growth forests reasonably early (ca.100 yrs.).

Hydnum repandum (Sweet Tooth, Pied-de-Mouton) is a major commercial species. In this region it is winter fruiting, from October to April, thus it spans the season between

chanterelle harvest in the fall and morel harvest in the spring.

B. Past Actions. Past harvest has greatly reduced the number and extent of populations.

C. Species Range. Widespread - including east coast and Europe, but most species uncommon.

D. Non-habitat Factors. Commercial harvest of *H. repandum*.

E. Inadequate Information. Taxonomy (there are some very rare unlisted species in this group), reproductive biology, especially commercially viable techniques to cultivate and manage commercial species, and the species-specific host range of mycorrhizal associates are not well known for this group.

F. Features of the Alternative. Main concern is the intensity of management in the matrix. Aggregation of leave trees is important for these species.

V. Cumulative Effects Assessment. Rotation length on non-federal land could be important to survival. Ultimately we may see management to encourage *H. repandum* for its own commercial value. Many prefer it to chanterelles.

VI. Summary. Ratings reflect relative abundance, combined with uncertainty of future availability of mid-successional stands.

A. Geographic Extent. Washington, Oregon and northern California

B. Specific Habitats. Late-successional conifer stands, also in mixed coastal hardwoods.

C. Mitigation Measures. Increase extent of 100+ year-old stands, especially in coastal areas. Monitor and regulate commercial harvest to maintain sustainability. Encourage co-cropping of *H. repandum* with commercial timber species. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Within harvest areas of the matrix, aggregate leave trees, maintain amounts of coarse woody debris that are representative of the natural stand conditions, and minimize site disturbance.

D. Benefits. Mitigation might improve rating, and will provide baseline data on distribution, abundance and ecology of the species.

I. Species. Rare Zygomycete (*Endogone acrogena*)

II. FEMAT Rating. 0-18-60-23

(collective rating for Rare Zygomycete group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This rare endemic occurs in mesic, low elevation old-growth forests of Douglas-fir and western hemlock; probably an ectomycorrhizal fungus.

B. Past Actions.

C. Species Range. Washington - western slopes of the Cascades from Mt. Rainier north to the Whitechuck River, Mt. Baker-Snoqualmie National Forest; Olympic National Park. The type locality is the "end of the Whitechuck River Road", Mt. Baker-Snoqualmie National Forest (the precise location can be obtained from the collector, Prof. David Hosford, Central Washington University, Ellensburg).

D. Non-habitat Factors. Extensive logging in low elevation old-growth has probably eliminated most of the habitat characteristic for this species.

E. Inadequate Information. Remaining low-elevation, old-growth Douglas-fir/western hemlock stands have not been thoroughly explored for hypogeous fungi.

F. Features of the Alternatives.

V. Cumulative Effects Assessment. All three known localities are on federal lands; most remaining low-elevation habitat suitable for this species is likely to be on federal lands.

VI. Summary. This rare endemic occurs in habitats at low elevations that have been decimated by logging. The Olympic and Mt. Rainier National Parks appear to be important refugia.

VII. Mitigation. Remaining habitat in the areas of the type locality and other known localities should be inventoried to determine extent of populations. Type locality and other known populations should be protected.

A. Geographic Extent. Western slopes of the Cascades from Mt. Rainier north to the Whitechuck River, Mt. Baker-Snoqualmie National Forest; Olympic National Park.

B. Specific Habitats. Type locality is "end of Whitechuck River Road," Mt. Baker-Snoqualmie National Forest; one collection from Mt. Rainier National Park and Olympic National Park.

C. Mitigation Measures. Initially designate 160 acres of similar habitat around the type locality of the species until ground survey can be conducted to determine extent of population. Survey to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Consider designation of Mycological Special Interest Area to protect type locality and known

populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of type and other localities will reduce risk of extirpation of the species.

I. Species. Rare Zygomycete (*Glomus radiatum*)

II. FEMAT Rating. 0-18-60-23
(collective rating for Rare Zygomycete group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. This species has a broad distribution but is rare in the range of the northern spotted owl. It occurs as an endomycorrhizal associate of mature to old-growth coastal redwood and Alaska yellowcedar in mesic to wet areas of thick humus, abundant coarse woody debris, and over a wide elevational range.

B. Past Actions.

C. Species Range. Known from only 3 localities in the range of the northern spotted owl. Northwest coast of California and upper-mid elevations of the Oregon and southern Washington Cascades; northeastern United States; Japan. One site is in the Lamb Butte Scenic Area, which contains several rare, local endemics and is proposed for designation as a Mycological Special Interest Area (see writeup for *Chroogomphus loculatus*).

D. Non-habitat Factors. Two of the three known localities are subject to heavy recreational use.

E. Inadequate Information. The widely disjunct localities suggest a more extensive range than is now known, at least in suitable habitats with suitable hosts. Neither coastal redwood nor Alaska yellowcedar stands, nor those of western redcedar, another possible host, have been intensively explored for this or other hypogeous species.

F. Features of the Alternative.

V. Cumulative Effects Assessment. The California site is on private land, but similar nearby sites in coastal redwoods are already preserved in national or state parks. The Alaska

yellowcedar localities are on federal land.

VI. Summary. Though occurring in the northeast United States and Japan, this species is rare in the western United States. Its rating reflects rarity and natural history more than features of the alternatives.

VII. Mitigation. Protection of known localities will reduce risk of extirpation.

A. Geographic Extent. (see Species Range)

B. Specific Habitats. Washington - Knuppenberg Lake, Gifford Pinchot National Forest, T 13 N., R 11 E., Sec. 10, SW 1/4. Oregon - The Potholes, Lamb Butte Scenic Area, Willamette National Forest, T 17 S., R 6 E., Sec. 22, SE 1/4. California - 2 miles south of Smith River.

C. Mitigation Measures. Restrict further recreational development at Knuppenberg Lake; initiate process of establishing Mycological Special Interest Area in the Lamb Butte Scenic Area. Inventory appropriate habitats in the northern Goat Rocks Wilderness Area and Redwoods National Park for other populations. Develop management guidelines to protect populations from adverse impacts; monitor for recreation impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities.

D. Benefits. Protection of known localities will reduce risk of extirpation of the species from the range of the northern spotted owl. Inventory of nearby suitable habitats may reveal the species to be more common than is now known.

I. Species Group. Uncommon Gilled Mushrooms - Saprobes

(<i>Baeospora myriadophylla</i>)	(<i>M. monticola</i> *)
(<i>Chrysomphalina grossula</i>)	(<i>M. overholtsii</i> * (wood))
(<i>Collybia bakerensis</i> * (wood))	(<i>M. quinaultensis</i> *)
(<i>Fayodia gracilipes</i> (syn. <i>F. rainierensis</i>))	(<i>M. tenax</i>)
(<i>Gymnopilus punctifolius</i> * (wood))	(<i>Mythicomycetes corneipes</i>)
(<i>Marasmius applanatipes</i> *)	(<i>Neolentinus kauffmanii</i> * (wood))
(<i>Mycena hudsoniana</i> *)	(<i>Pholiota albivelata</i> *)
(<i>M. lilacifolia</i> (wood))	(<i>Stagnicola perplexa</i>)
(<i>M. (Hydropus) marginella</i> (wood))	

II. FEMAT Rating. 40-35-15-10
(collective rating for Uncommon Gilled Mushroom - Saprobes Group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of

these species and impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. These species are all saprobic and either occur on litter/humus and/or coarse woody debris. Those restricted to logs or stumps are noted above. Certain species require recently fallen logs, *e.g.*, *Collybia bakerensis*, while others occur on well decomposed logs, *e.g.*, *Gymnopilus punctifolius*. *Neolentinus kauffmanii* occurs only on the wood of Sitka spruce. Some species are restricted to low or mid-elevation late-successional forests, while others are more generally distributed in conifer ecosystems. Many species fruit in the late summer, fall and/or winter seasons depending on geographic location. Others, *e.g.*, *Mycena overholtsii* and *Collybia bakerensis* occur earlier in the year, the former frequently associated with melting snow banks.

B. Past Actions. Habitats for these species have been reduced by logging of old-growth forests.

C. Species Range. Species marked with an * are endemic to the Pacific Northwest, others occur well outside the Pacific Northwest. The overall distributions are poorly known in general. A number likely occur across northern California, Oregon and Washington in appropriate habitats but this has not been documented. Others may be more restricted in their distribution, for example, *Marasmius applanatipes*, so far is known only from certain populations in California.

D. Non-habitat Factors. Air pollution could result in the decline of some of these species.

E. Inadequate Information. The overall distributions for these species are not available and their ecology and habitat requirements are not fully understood. All are in need of further study.

F. Features of Alternatives. Overall acreage and distribution of late successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species. Management of matrix areas is important for developing future habitats for these species.

V. Cumulative Effects of Assessment. Reports of these species have often been from federal lands, however, there is no database for precise distributions. Therefore, populations on non-federal lands could be important for continuity of species within their natural ranges. The distribution and frequency of these species has likely been influenced by logging of late-successional forests. The potential negative effect of air pollution and global climate change can not be predicted.

VI. Summary. Ratings reflect the fact that these species are relatively uncommon and/or have specific habitat and/or substrate requirements. They are characteristic of late-successional forests. The overall range, frequency, reproduction, habitat requirements and general ecology of most of these species are in need of further study.

VII. Mitigation. Mitigation will improve ratings for these species.

A. Geographic Extent. Species marked with an * are endemic to the Pacific Northwest, however, others occur well outside the Pacific Northwest. The distributions for some species are poorly known overall. Certain species be more restricted in distribution, for example, *Marasmius applanatipes*, is known only from certain populations in California.

B. Specific Habitat. Saprobiic species that either occur on litter/humus and/or coarse woody debris. Some species are restricted to low or mid-elevation late-successional forests, while others are more generally distributed in conifer ecosystems. *Neolentinus kauffmanii* is restricted to wood of Sitka spruce.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations. Determine if management is necessary to protect known populations. If so, protect known populations by providing a buffer zone adequate to maintain integrity of habitat and microclimate of the site. Map and monitor populations and determine habitat requirements for each species. Management of matrix areas adjacent to known populations should be toward establishing late-successional forest habitats. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Survey will provide baseline data on the overall distributions and habitat requirements of individual species as well as improve their ratings. Known populations for species at risk, or those that are rare and locally distributed would be protected. Mitigation will reduce risk of extirpation.

I. Species Group. Rare Gilled Mushrooms - Saprobes

(*Clitocybe subditopoda*)

(*Clitocybe senilis*)

(*Rhodocybe nitida*)

II. FEMAT Rating. 0-40-38-23

(collective rating for Rare Gilled Mushroom - Saprobe group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of these species and may impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. These are saprobic species, except possibly *Rhodocybe nitida* which may be ectomycorrhizal. They are rare to uncommon in late-successional forests, and require relatively moist habitats with a deep humus and litter layer. Fruiting is during the summer and fall seasons.

B. Past Actions. Habitat for these species has been reduced by logging of old-growth forests, especially at lower elevations.

C. Species Range. Pacific Northwest and likely occur in Washington, Oregon and California, however, there are few known localities. *Rhodocybe nitida* has only been documented for certain from Washington.

D. Non-habitat Factors. Air pollution could result in the decline of these species, especially if *Rhodocybe nitida* is determined to be ectomycorrhizal.

E. Inadequate Information. Accurate distributions for these species are not available and their ecology and habitat requirements need further study.

F. Features of Alternatives. Overall acreage and distribution of late-successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species.

V. Cumulative Effects of Assessment. Known populations are primarily on federal lands. As these species are characteristic of low to mid-elevation late-successional forests, it is likely their distribution and frequency has been effected by logging. Populations on non-federal lands may be important for connectivity of species within their range.

VI. Summary. Ratings reflect the rareness of these species, their close association with low to mid-elevation late-successional forests, and the lack of information on their overall range, frequency, reproduction, habitat requirements and general ecology.

VII. Mitigation. Mitigation will improve the ratings for these species.

A. Geographic Extent. It is likely these species all occur in Washington, Oregon and California, however, there are few known populations. Thus far, *Rhodocybe nitida* has only been documented for Washington.

B. Specific Habitat. Late-successional forests with relatively moist habitats and a well-developed humus and litter layer. They occur primarily in low to mid-elevation forests.

C. Mitigation Measures. Survey known sites to delineate boundaries of habitat and populations. Protect known populations by providing a buffer that is adequate to maintain habitat and microclimate conditions. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Evaluate species distribution on federal lands to determine if populations are isolated or face extirpation. Determine if non-federal lands are important for providing connectivity between populations, particularly in low elevation

and coastal forests. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa. Management of matrix areas adjacent to known populations should be toward establishing late-successional forest habitats. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Mitigation to protect known populations may reduce risk of extirpation. Surveys will provide baseline data on the distribution and habitat requirements of these species and may improve their ratings.

I. Species Group. Rare Gilled Mushrooms - Saprobies

(Neolentinus adherens)

(Rhodocybe speciosa)

(Tricholomopsis fulvescens)

II. FEMAT Rating. 0-40-38-23

(collective rating for Rare Gilled Mushrooms - Saprobes group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. These species are considered rare and known populations are few. All require well-developed relatively moist late-successional forests. Species fruit only on large coarse woody debris, especially large logs in later stages of decay. Primarily fruit in the fall.

B. Past Actions. Habitats for these species have been reduced by logging of old-growth forests at low to mid-elevations.

C. Species Range. *Neolentinus adherens*: known populations, Soleduck River, Olympic National Park. *Rhodocybe speciosa*: reported from a few populations from Mt. Rainier National Park north to Barlow Pass. *Tricholomopsis fulvescens*: reported from Mt. Hood area, Mt. Rainier National Park and Barlow Pass, Mt. Baker-Snoqualmie National Forest. For the latter two species the location of only one population is currently known.

D. Non-habitat Factors. Air pollution could result in the decline of these species.

E. Inadequate Information. Accurate distributions for these rare species are not available. There is inadequate information on ecology and habitat requirements.

F. Features of Alternatives. Overall acreage and distribution of late-successional

forests, and management of the matrix were important features of the alternatives that influenced the original rating of these species.

V. Cumulative Effects of Assessment. Known populations are on federal lands. These species are characteristic of low to mid-elevation late-successional forests; their distribution and frequency may have been impacted by logging. Populations on non-federal lands are important in terms of connectivity of the species within their ranges.

VI. Summary. Ratings reflect the rareness of these species, their seemingly close association with low to mid-elevation late-successional forests, and the lack of information on their overall range, frequency, habitat requirements and general ecology.

VII. Mitigation. Mitigation will improve the ratings for these species.

A. Geographic Extent. Overall distributions are unknown. *Neolentinus adherens*: known populations, Soleduck River, Olympic National Park. *Rhodocybe speciosa*: reported from few populations, one known, Mt. Rainier National Park north to Barlow Pass. *Tricholomopsis fulvescens*: reported from Mt. Hood area, Mt. Rainier National Park and Barlow Pass (only known population). *Rhodocybe speciosa* and *Tricholomopsis fulvescens* are possible endemics.

B. Specific Habitat. Well developed late-successional forests, relatively moist sites with abundant coarse woody debris. Species require large logs in later stages of decay.

C. Mitigation Measures. Manage to protect known populations by surveying to delineate boundaries of habitat and population, establish buffer around known populations to maintain habitat and microclimate conditions and to provide for adequate protection of population. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop and maintain GIS layer and associated database of known locations. Management of matrix areas adjacent to known populations should be toward establishing late-successional forest habitat with large coarse woody debris distributed on the landscape in natural numbers and patterns. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Mitigation will provide baseline data on the distribution and habitat requirements of these species as well as improve their ratings. Known populations would be protected.

I. **Species.** *Fuzzy Sandoze, Noble Polypore (Oxyporus nobilissimus)*

II. **FEMAT Rating.** 10-25-43-22

III. **Modifications due to changes in Alternative 9.** If this species is discovered in California, then the management of matrix areas could become important in relation to its distribution. Matrix areas associated with this species should be managed to promote its growth and reproduction.

IV. **Explanation of Rating.**

A. **Natural History.** This is a rare and endangered species. A perennial shelf fungus/conk, often producing extremely large fruit bodies. Occurs on stumps, snags and living trees, probably saprobic (type of decay under investigation). Typically occurs on *Abies*, particularly *A. procera*. Occurs in late-successional forests, especially in old- and ancient stands and requires very large diameter substrates. Also can persist on ancient large stumps in second growth for a number of years. It has not been found on logs.

B. **Past Actions.** The removal of old-growth forests through logging, particularly in the range of *Abies procera*, has had an impact on this species. It is considered rare and in need of protection. Listed as rare and endangered by the Oregon Natural Heritage Program and under consideration for similar status in Washington.

C. **Species Range.** Endemic to the states of Washington and Oregon, from Snow Peak, Linn County, Oregon north to Asahel Curtis Nature Trail, King County, Washington in the Cascades; on the East Fork of the Humptulips River, Olympic Peninsula. Also reported but not verified from the coast range in Oregon.

D. **Non-habitat Factors.** Air pollution and global climate change could directly or indirectly cause the decline of this species.

E. **Inadequate Information.** This species has been studied for the past two years and a preliminary report on its distribution and ecology are forthcoming.

F. **Features of Alternatives.** Overall acreage and distribution of late successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species. Management of matrix areas is important for developing future habitats in which they can grow.

V. **Cumulative Effects of Assessment.** All known populations of this species are on federal lands; a number are in reserves or parks where it has been protected from logging. Its distribution and frequency have been impacted by logging particularly of *Abies procera*. This makes any populations that occur on non-federal lands extremely important to the survival of this species across its natural range.

VI. **Summary.** Ratings reflect the rareness of this species and the fact that living specimens have only been found at six locations in Oregon and Washington. It appears restricted to

Abies, especially *Abies procera*, and occurs only on the bases of living trees and on snags and stumps. It occurs primarily on large diameter, old trees, snags and stumps so that it has specialized substrate requirements. It requires immediate protection and long term monitoring, e.g., 100 years or more.

VII. Mitigation. Mitigation may not improve the rating of this species but could prevent the extirpation of known populations and extinction of the species.

A. Geographic Extent. Endemic to Oregon and Washington, occurring from Linn County, Oregon north to the Snoqualmie Pass area in the Cascades and on the Humptulips River, Olympic Peninsula. Reported but not verified from the Oregon coast range. Living populations known from only six locations.

B. Specific Habitat. Late successional, especially old growth and ancient forests, on large diameter trees, snags and stumps, never on logs, closely associated with *Abies*, especially *Abies procera*. Found also on very large stumps in second growth forests where it may persist for many years but likely will not survive.

C. Mitigation Measures. All known populations should be protected with buffer of a least one or more square miles with the fungus population centrally located. Survey and inventory suitable habitat to find additional populations. All populations should be precisely mapped and data maintained in a GIS layer and associated database. Long-term monitoring (100+ years) should be established for known populations. Details of reproduction should be investigated and genetic diversity of all populations determined using modern molecular techniques. Management of reserves and matrix areas with suitable habitat, especially in the vicinity of known populations, should be managed to improve connectivity between populations and prevent further isolation of populations or their extirpation. This species requires large areas of late-successional forests with natural distribution of large diameter stumps, snags and trees. Late successional forests suitable for this species must be maintained and developed to insure its long term survival. The management of matrix or reserves where removal of trees is planned should be evaluated for potential impact to this species if suitable habitat for its growth and reproduction occurs.

Species should be placed on the rare and endangered list by the Natural Heritage Program in Washington State, and Region 6 Regional Forester's Sensitive Species List, to ensure protection regionally on all lands. This species should be evaluated for national listing with U.S. Fish and Wildlife Service.

D. Benefits. Mitigation may prevent this fungus from extirpation, although it is extremely rare, so there is uncertainty about this species' viability. It will be difficult to restore its natural distribution and frequency, especially at low elevations in areas previously occupied with late-successional forests.

I. Species. Bondarzew's Polypore (*Bondarzewia montana*)

[listed in FEMAT as *Bondarzewia "mesenterica"* (sic!) and as Other Polypore]

II. FEMAT Rating. 30-25-30-15

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. **Natural History.** Rare saprobe causing root rot. In North America it is most widespread in the Pacific Northwest. There are two reports of local abundance outside of the region (Priest Lake and Tahoe). Generally at higher elevations and associated with *Abies*; always associated with late-successional forest. Produces large conspicuous fruiting body on soil above roots. Fruits repeatedly in the same location, indicating populations long lived. Edible, but tough and bitter, thus rarely taken despite large size. No commercial harvest.

B. **Past Actions.** Some populations may have been eliminated by past logging, but in general its range is above the elevations of most intense harvest.

C. **Species Range.** Pacific Northwest to Idaho and western Nevada at high elevations. Also widespread but rare in Eurasia.

D. **Non-habitat Factors.** Potential climate change may affect southern extent of species, reducing some of few sites in FEMAT region. Air pollution likely a problem in more developed areas.

E. **Inadequate Information.** Need more detailed distribution information, and to determine if it is confined to *Abies* as a host species.

F. **Features of the Alternative.** Much of the potential habitat is protected as congressionally or administratively withdrawn lands. However, concerns for this rare species viability need to be addressed in non-timber development of higher elevation lands.

V. **Cumulative Effects Assessment.** Increased harvest of higher elevation sites on non-federal land may eliminate populations. Increased recreational/summer residential development may eradicate some population directly and may impact others by creating local pockets of elevated atmospheric sulfur and nitrogen.

VI. **Summary.** Ratings reflect rarity and uncertainty about future management of high elevation lands.

A. **Geographic Extent.** Higher elevations throughout FEMAT, with special concern for southern edge of range in California.

B. **Specific Habitats.** High elevation, late successional forests with *Abies*.

C. **Mitigation Measures.** Survey to determine specific sites, delineate boundaries of

habitat and populations. Establish buffer around populations to provide adequate protection, and to maintain appropriate habitat and microclimatic conditions. Survey suitable habitat to find additional populations. Monitor southern sites to detect impact of potential climate change. Monitor sites adjacent to recreational development to detect impacts of heavy human use, trampling, and air pollution. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa.

D. Benefits. Mitigation, including survey which may find sufficient additional sites, may improve ratings. Protection of known populations will reduce risk of extirpation.

I. Species Group. Rare Resupinates and Polypores

(*Aleurodiscus farlowii*)
(*Dichostereum granulosum*)
(*Grandinia microsporella*)
(*Phlebia diffusa*)
(*Polyporoletus sublividus*)
(*Postia rennyii*)
(*Scytinostroma cf. galatinum*)

II. FEMAT Rating. 0-50-25-25
(collective rating for Rare Resupinate and Polypore group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Presumed saprobes of wood, humus, litter, etc. This is but small fraction of uncommon to rare resupinates and polypores that occur in this region. Most are known from a very small number of sites, often a single collection.

B. Past Actions. Past harvests and site preparation has undoubtedly eradicated many populations. However, in the case of some of these species, the creation of stumps and large dead roots may have created suitable habitat.

C. Species Range. Pacific Northwest, northern California and elsewhere.

D. Non-habitat Factors.

E. Inadequate Information. Taxonomy, distribution, reproductive biology, ecology are not well known. Species may have potential ecological and economic importance (e.g. some may be pathogens; others potential industrial organisms -- bioremediation, medicinals, biological control agents, commercial fermenters, etc.).

F. Features of the Alternative.

V. Cumulative Effects Assessment. Insufficient information about distribution and habitat requirements to evaluate.

VI. Summary. Ratings reflect apparent scarcity more than features of the alternatives.

VII. Mitigation. Mitigation might improve ratings, especially of individual species.

A. Geographic Extent. Washington, Oregon and northern California

B. Specific Habitats.

C. Mitigation Measures. Protect currently known sites. Survey to delineate boundaries of populations and establish adequate buffer to maintain integrity of habitat and microclimate. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations.. A prime requirement for mitigation will be acquisition of more knowledge. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Protection of known populations will reduce the risk of extirpation. Survey will provide baseline data on these species from which we can determine the effects of forest management practices on their distribution, frequency, habitat requirements, general ecology and reproduction, and is expected to result in improved ratings for some species.

I. Species. Uncommon Cup Fungi

(*Cudonia circinans*)

(*Cudonia monticola*)

(*Spathularia flavida*)

II. FEMAT Rating. 70-30-0-0
(collective rating for Cup Fungi)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The majority of rated cup-fungi are operculate cup fungi (order Pezizales); these three species are inoperculate cup fungi (order Leotiales). There are

many more species of inoperculate cup fungi in the FEMAT region. Most are microfungi, *i.e.* they are too small and inconspicuous to rank as macrofungi. A few are plant pathogens, some are mycorrhizal. Widespread but uncommon in mature conifer forests with a well-developed duff layer.

B. Past Actions. Harvest of old-growth has drastically reduced populations in the FEMAT region.

C. Species Range. Northeast and northwest North America, also Eurasia.

D. Non-habitat Factors.

E. Inadequate Information. Reproductive biology, local abundance, and distribution are not well known.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Management of non-federal lands, especially availability of older conifer forests at all elevations, will affect ratings.

VI. Summary. Ratings reflect uncertainties about availability of late-successional conifer stands on non-federal lands.

VII. Mitigation. Mitigation could improve ratings.

A. Geographic Extent. Washington, Oregon, northern California.

B. Specific Habitats.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations. Within harvest areas in the matrix, aggregate leave trees to provide adequate interior microclimate and duff layer, minimize site disturbance during treatments. Monitor populations to determine recreation impacts, particularly in higher elevation stands.

D. Benefits. Mitigation should prevent extirpation of the species, and will likely improve the original rating. Mitigation will also provide baseline information on the distribution, frequency, habitat requirements, general ecology and reproduction of these species.

I. Species. Uncommon Cup Fungi - *Gyromitra* spp. (False Morels)

(*Gyromitra californica*)
(*Gyromitra esculenta*)
(*Gyromitra infula*)
(*Gyromitra melaleucoides*)
(*Gyromitra montana* (syn. *G. gigas*))

II. **FEMAT Rating.** 70-30-0-0
(collective rating for Cup Fungi group)

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** The gyromitras are a special case. Probably each species should be dealt with separately. Most are saprobic on soil, presumably feeding on decaying matter in the soil. However, *G. infula* is saprobic on rotten to very rotten wood. Several species are gathered as food for domestic consumption. *G. esculenta* is gathered commercially in Europe. Paradoxically, *G. esculenta* is poisonous -- deadly in fact. It contains monomethyl hydrazine (or a closely related molecule) which is cumulative and lethal. However, the toxin is volatile at just above room temperature, thus is driven off during cooking, canning, or heat drying.

B. **Past Actions.** *G. esculenta* may actually prefer second-growth, thus past harvest may have created habitat for this species. The other species prefer older forests.

C. **Species Range.** *G. esculenta* is most common in northwestern North America and Europe. Other species are endemic.

D. **Non-habitat Factors.** *G. esculenta* is a potential candidate for commercial exploitation. All are potentially at risk of overexploitation for local use.

E. **Inadequate Information.** Reproductive biology. Although there are several fairly extensive taxonomic treatments, taxonomy is still unresolved.

F. **Features of the Alternative.**

V. **Cumulative Effects Assessment.** Management of non-federal lands and control of commercial and non-commercial harvest may be critical. One well-publicized lethal poisoning could limit or terminate harvest.

VI. **Summary.** Long term survival of each species depends on its harvest and/or management of mid-successional forests on federal and non-federal lands.

VII. **Mitigation.** Monitor species and control harvest if necessary to protect species viability, or prevent risk of local extirpation. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect

known populations. Within harvest areas in the matrix, aggregate leave trees, maintain amounts of coarse woody debris that are representative of the natural stand conditions, and minimize site disturbance during treatments.

V. **Benefits.** Mitigation will provide baseline information on the distribution, frequency, habitat requirements, general ecology and reproduction. Control of commercial harvest if necessary, may prevent a decline in species viability.

I. **Species.** Uncommon Cup Fungi - *Otidea* spp. (Rabbit Ears)
(*Otidea leporina*)
(*Otidea onotica*)
(*Otidea smithii*)

II. **FEMAT Rating.** 70-30-0-0
(collective rating for Cup Fungi group)

III. **Modifications due to changes in Alternative 9.** Shortened rotations in northern California will affect ratings negatively.

IV. **Explanation of Rating.**

A. **Natural History.** *Otidea leporina* and *O. onotica* are widespread, but uncommon. *Otidea smithii* is a Pacific Northwest endemic. All species are saprobes on conifer duff in moist to wet, late-successional stands. There is a probability that further taxonomic exploration will turn up one or more rare endemics in this genus. There are existing species names for what may be varieties or may be rare species. Regional treatments list these species as "common", but that should probably read, "common for a cup-fungus". None is as common as many common mushrooms.

B. **Past Actions.**

C. **Species Range.**

D. **Non-habitat Factors.**

E. **Inadequate Information.** Needs taxonomic study, reproductive biology.

F. **Features of the Alternative.** Management of matrix, specifically grouping of leave trees will affect ratings.

V. **Cumulative Effects Assessment.** Availability of suitable habitat on non-federal lands will affect status.

VI. **Summary.** Recommend changing original rating to 60-20-15-5 based on uncertainty of

availability of habitat.

VII. Mitigation. Mitigation could improve proposed new rating, not original rating.

A. Geographic Extent. Throughout FEMAT region.

B. Specific Habitats. Late-successional, wet, mid-to low elevation, conifer forests.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations. Within harvest areas in the matrix, aggregate leave trees, maintain amounts of coarse woody debris that are representative of the natural stand conditions, and minimize site disturbance during treatments.

D. Benefits. Mitigation will provide baseline information on the distribution, frequency, habitat requirements, general ecology and reproduction. Mitigation will reduce risk of extirpation, and may improve habitat for the species within matrix lands.

I. Species. Uncommon Cup Fungi (*Plectania melastoma* (Jelly-Like Black Urn))

II. FEMAT Rating. 70-30-0-0
(collective rating for Cup Fungi group)

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Widespread but uncommon saprobe on conifer litter. Two related species are rare (see *Plectania latahensis*, *P. milleri*).

B. Past Actions. Timber harvest has eradicated populations, but this species can re-establish in post canopy closure second-growth.

C. Species Range. Northeast and northwest North America and Europe.

D. Non-habitat Factors.

E. Inadequate Information. Reproductive biology not well known. Although the taxonomy of this species seems clear, there are several undescribed, closely related species.

F. Features of the Alternative. The key feature is the availability of late-successional to

old-growth conifer forest with a well-developed duff layer.

V. Cumulative Effects Assessment.

VI. Summary. This species probably rated correctly at 70-30-0-0.

VII. Mitigation. Not needed.

I. Species. *Podostroma alutaceum*

II. FEMAT Rating. 70-30-0-0
(collective rating for Cup Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. This is not a cup fungus, though it resembles both some cup fungi (e.g. *Spathularia*) and some unbranched corals (e.g. *Clavariadelphus*). Its nearest relatives in this assessment are listed as rare parasites. *Podostroma alutaceum* is saprobic on partly-decayed wood fragments in conifer duff. In addition, it probably feeds on other fungi in the wood. Occurs in mature conifer, or mixed conifer-hardwood forests.

B. Past Actions. Past clearcutting of old-growth conifer stands has eradicated populations.

C. Species Range. Widespread but rare throughout North America; also rare in Europe.

D. Non-habitat Factors.

E. Inadequate Information. Since this species reappears in the same site, but is rare, information is needed identifying specific sites of populations. Reproductive biology is not well known. This species may have potential for biological control of wood decay fungi.

F. Features of the Alternative. Key feature is retention of suitable late-successional conifer forest.

V. Cumulative Effects Assessment. Since this is a rare species, protection of few sites on non-federal land may be key to its survival.

VI. Summary. Original rating optimistic - recommend changing rating to 30-30-30-10.

VII. Mitigation. Mitigation needed to protect species from extirpation.

A. Geographic Extent. Range of the northern spotted owl.

B. Specific Habitats. Late-successional conifer forests.

C. Mitigation Measures. Survey known populations to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Include this species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa. Within harvest areas in the matrix, aggregate leave trees, maintain amounts of coarse woody debris that are representative of the natural stand conditions and minimize site disturbance.

D. Benefits. Protection of known populations will reduce risk of extirpation. Survey will provide baseline information on the distribution, frequency, habitat requirements general ecology and reproduction.

I. Species. Uncommon Cup Fungi (*Sarcosphaera eximia* (Crown Fungus))

II. FEMAT Rating. 70-30-0-0
(collective rating for Cup Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Ectomycorrhizal on conifers (in this region) or Fagaceae. Species in need of taxonomic treatment. Species may be monotypic, or two or more species. If more than one species, then this one may need protection. If only one species, then probably not threatened. Fruits sometimes below ground (hypogeous), sometimes above ground (epigeous), thus intermediate in fruiting between truffles and cup fungi. European species/strain mostly occurs on chalky soils.

B. Past Actions. Harvest has eradicated populations, but species will re-establish in post canopy closure second-growth.

C. Species Range. Assuming one species, California, Pacific Northwest, Rockies, northeast United States and Europe.

D. Non-habitat Factors.

E. **Inadequate Information.** Taxonomy in need of treatment to determine how many species are represented in this current taxon. Reproductive biology and dispersal mechanisms not well known.

F. **Features of the Alternative.** Although it occurs here on acid, pumice-derived soils, it may be favored by limestone-derived soils. In general, we expect more diversity of cup-fungi on soils with high calcium content. Such sites may need to be identified as of particular importance for this and other cup-fungi.

V. **Cumulative Effects Assessment.**

VI. **Summary.** Giving present knowledge, original rating adequate.

VII. **Mitigation.** Probably not needed.

I. **Species.** Uncommon Cup Fungi (*Sarcosoma mexicana* (Giant Gel Cup))

II. **FEMAT Rating.** 70-30-0-0
(collective rating for Cup Fungi group).

III. **Modifications due to changes in Alternative 9.** This species may be significantly affected by rotation length in northern California. Longer rotations in California, especially in north coastal forests, may provide opportunity to establish new populations.

IV. **Explanation of Rating.**

A. **Natural History.** Originally described from Mexican material collected from high elevation conifer site south of Mexico City, it has since apparently been extirpated from its type locality in Mexico. Its distribution in the FEMAT region reflects its southern origins, e.g. it occurs where winters are relatively mild and wet.

B. **Past Actions.** Extensive harvest in Coast Range has undoubtedly extirpated many populations, but the species seems to be able to re-establish in second growth following canopy closure.

C. **Species Range.** This species is known from scattered locations, mostly in the Coast Range. West coast endemic.

D. **Non-habitat Factors.**

E. **Inadequate Information.** Reproductive biology. Location of specific sites and general distribution. Does it still occur in Mexico, if so, where?

F. **Features of the Alternatives.**

VI. **Summary.** Additional information available since original rating suggests that original rating optimistic for this species, and should be changed to reflect concerns about loss of habitat and lower viability. Rating should be changed to 60-20-15-5.

IV. **Mitigation.** Mitigation is necessary to protect this uncommon fungus and improve its viability.

A. **Geographic Extent.** Scattered distribution throughout FEMAT region, mostly in Coast Range of Oregon and California.

B. **Specific Habitats.** Late-successional and old-growth forests.

C. **Mitigation Measures.** Retain longer rotations in coastal California matrix. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations. Within harvest areas in the matrix, aggregate leave trees, maintain amounts of coarse woody debris that are representative of the natural stand conditions, minimize site disturbance. Determine when this species enters stands during forest succession.

D. **Benefits.** Mitigation will provide baseline information on the distribution, frequency, habitat requirements general ecology and reproduction. Mitigation will reduce risk of extirpation, and may improve habitat for the species within matrix lands. Mitigation is needed to protect this uncommon species.

I. **Species.** Rare Cup Fungi (*Aleuria rhenana* (Stalked Orange Peel Fungus))

II. **FEMAT Rating.** 0-35-38-28
(collective rating for Rare Cup Fungi group)

III. **Modifications due to changes in Alternative 9.** None

IV. **Explanation of Rating.**

A. **Natural History.** Widespread but rare saprobic species. Dependent on well developed conifer litter, but apparently independent of species, e.g. redwood, spruce, Douglas-fir. Only found in late-successional conifer forests.

B. **Past Actions.** Clear-cutting undoubtedly destroyed some populations, but no documentation.

C. **Species Range.** Five known populations in the Pacific Northwest, from "near San Francisco" to Mt. Rainier. Remarkably wide range of latitude and altitude, sea level

upwards to near treeline. One known population in New York (near the top of Mt. Marcy in Adirondacks), plus at least two others in eastern North America. Also in Europe, but rare.

D. Non-habitat Factors. Not known.

E. Inadequate Information. Taxonomy well established, but urgent need to identify specific sites. No information on reproductive strategy.

F. Features of the Alternative. Primary feature is retention and creation of late-successional stands.

V. Cumulative Effects Assessment. Further harvest of late-successional stands on non-federal lands may be crucial to survival. Two of four known sites in Pacific Northwest are on protected non-federal lands. One of these may be threatened by increasing public recreational use.

VI. Summary. Ratings reflect rarity and uncertainty of protection of very few specific sites.

VII. Mitigation. Mitigation might improve ratings for this species if survey located numerous other sites.

A. Geographic Extent. Throughout FEMAT range.

B. Specific Habitats. Late-successional conifer stands.

C. Mitigation Measures. Include this species in surveys of macrofungi in wide range of late-successional conifer types. Protect and monitor all known sites. Establish buffer around known locations to provide for adequate protection of population, and to maintain appropriate habitat and microclimatic conditions. Develop management guidelines to protect populations from adverse impacts. Develop and maintain GIS layer and associated database for locations of rare or locally endemic taxa. Initiate studies of reproductive strategy in order to be able to rescue species by culture and reintroduction if needed.

D. Benefits. Mitigation is likely to improve ratings, and reduce risk of extirpation.

I. Species. Rare Cup Fungi (*Bryoglossum gracile* (syn: *Mitrula gracilis*))

II. FEMAT Rating. 0-35-38-38
(collective rating for Rare Cup Fungi group)

III. Modifications Due to Changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Saprobe, or possible parasite, on mosses (*Hylocomium splendens* and probably others) in wet, high elevation, conifer sites. Often mistaken for more common *Mitrula* spp. which are leaf saprobes at lower elevations. Rare, or possibly just overlooked.

B. Past Actions. Not a primary factor in rating.

C. Species Range. Arctic and alpine, upper montane, probably throughout alpine in North America and Europe. Only one documented site in FEMAT region.

D. Non-habitat Factors. Potential global warming may have impact. Air pollution may affect species directly, or, in case of heavy metals or toxic organics, through accumulation by moss.

E. Inadequate Information. Inadequate information about distribution, especially specific sites. Inadequate information about potential effects of airborne toxics. No information about reproductive biology.

F. Features of the Alternative. Primary factor is protection of high elevation conifer sites.

V. Cumulative Effects Assessment. Recreational or summer residential development of non-federal high elevation lands may impact specific populations directly, increase human impact on adjacent federal lands, or increase local levels of airborne toxics.

VI. Summary. Ratings reflect perceived species rarity.

VII. Mitigation. Mitigation could improve rating.

A. Geographic Extent. Montane areas of FEMAT region

B. Specific Habitats. Mossy, wet, alpine/subalpine, upper montane conifer forests.

C. Mitigation Measures. Survey to delineate boundaries and habitat of known populations, survey suitable habitat to find additional populations, and to develop additional information on distribution, abundance, habitat and ecology. If confirmed rare, protect specific sites by establishing buffer around population. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa. Determine if management is necessary to protect known populations. Monitor recreation impacts. Investigate secondary impact of atmospheric toxics.

D. Benefits. Mitigation could improve rating.

- I. **Species.** Rare Cup Fungi (*Gelatinodiscus flavidus*)
- II. **FEMAT Rating.** 0-35-38-28
(collective rating for Rare Cup Fungi group)
- III. **Modifications due to changes in Alternative 9.** None
- IV. **Explanation of Rating.**
 - A. **Natural History.** Saprobe or weak pathogen. Limited to needles, cones, twigs of Alaska yellowcedar. Fruiting occurs only at edges of snow melt, either under the snow or in rivulets of runoff. Basic biology, including reproductive, is well studied.
 - B. **Past Actions.** Not a major factor in ratings.
 - C. **Species Range.** Documented collections: British Columbia, Olympic Peninsula, North Cascades, Oregon Cascades, Central Oregon.
 - D. **Non-habitat Factors.** Impact of acid rain not known. Potential global warming may shift range northward and possibly eliminate species from the range of the northern spotted owl.
 - E. **Inadequate Information.** Need more information on distribution.
 - F. **Features of the Alternative.** Primary feature is extent of high elevation populations of Alaska yellowcedar.
- V. **Cumulative Effects Assessment.** Known sites are on federal land.
- VI. **Summary.** Ratings reflect scarcity of known populations.
- VII. **Mitigation.** Mitigation might improve ratings.
 - A. **Geographic Extent.** Range of Alaska yellowcedar within the range of the northern spotted owl.
 - B. **Specific Habitats.** (see Natural History)
 - C. **Mitigation Measures.** Survey snow melt sites in Alaska yellowcedar stands throughout the region to determine distribution, abundance, habitat and ecology. Protect known populations until abundance and distribution can be determined for the species. If scarce, protect populations by providing adequate buffer to maintain appropriate habitat and microclimatic conditions. Develop and maintain interagency GIS layer and associated database on species locations.
 - D. **Benefits.** Mitigation (survey) might improve rating and protection of known populations would reduce risk of extirpation.

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- I. **Species.** Rare Cup Fungi - *Helvella* spp. (Elfin Saddles)
(*Helvella compressa*)
(*Helvella crassitunicata*)
(*Helvella elastica*)
(*Helvella maculata*)
- II. **FEMAT Rating.** 0-35-38-28
(collective rating for Rare Cup Fungi group)
- III. **Modifications due to changes in Alternative 9.** None
- IV. **Explanation of Rating.**
- A. **Natural History.** Presumed saprobes. Possibly facultative mycorrhizal. Fruit on soil. Uncommon to rare. Associated with late-successional forest where they often fruit in limited open sites along paths or streams.
- B. **Past Actions.** Although past clearcutting has probably destroyed some populations, scarcity of known sites was the primary basis for rating.
- C. **Species Range.** Widespread, but uncommon, in temperate forested areas of North America and elsewhere.
- D. **Non-habitat Factors.** Impacts of acid rain or potential global warming not known.
- E. **Inadequate Information.** Need more information on distribution and specific sites. Almost nothing known of reproductive biology.
- F. **Features of the Alternative.** Although these are not strictly riparian species, appropriate management of riparian zones is probably best contribution to survival.
- V. **Cumulative Effects Assessment.** All species known from non-federal lands, thus long term survival depends in part on management of non-federal forests.
- VI. **Summary.** Ratings reflect apparent scarcity.
- VII. **Mitigation.** Mitigation might improve ratings.
- A. **Geographic Extent.** Entire FEMAT range.
- B. **Specific Habitats.** Riparian and other low to mid-elevation wet forests.
- C. **Mitigation Measures.** Survey to determine distribution, abundance, habitat and ecology. Survey known locations to delineate boundaries of habitat and population.

Protect known sites by establishing adequate buffer around population to maintain appropriate habitat and microclimate. Develop management guidelines to protect populations from adverse impacts. Develop interagency GIS layer and associated database on locations of rare or locally endemic taxa. Research reproductive biology.

D. Beneficial Effects. Mitigation might improve ratings. Protection of known populations may reduce risk of extirpation.

I. Species. Rare Cup Fungi (*Neournula pouchetii* (Western Urnula, Rose Goblet syn. *Neournula nordmanensis*))

II. FEMAT Rating. 0-35-38-28
(collective rating for Rare Cup Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Rare. Saprobe on conifer litter, principally if not exclusively *Thuja* or *Tsuga*. Fruits late spring, early summer. Occurs in late-successional stands, typically 200 or more years old.

B. Past Actions. Logging has presumably destroyed populations, but primary basis for rating is scarcity.

C. Species Range. British Columbia, Washington, northern Idaho, northern Oregon, eastern Canada (also reported from N. Africa ?!).

D. Non-habitat Factors. Potential global warming could push range north out of the range of the northern spotted owl. Air pollution effects will likely be indirect through impact on overstory trees.

E. Inadequate Information. Need more information on distribution and other populations, if any. No information available on reproductive biology.

F. Features of the Alternative. Primary concern is protection of oldest cedar and hemlock stands.

V. Cumulative Effects Assessment. Known sites in region area are mostly federal land, however survival in Pacific Northwest may also depend on management of non-federal forests.

VI. Summary. Ratings reflect species scarcity.

VII. Mitigation. Mitigation unlikely to improve rating.

A. Geographic Extent. Northern Oregon and Washington

B. Specific Habitats. Late-successional *Thuja* and *Tsuga* stands.

C. Mitigation Measures. Survey known locations to delineate boundaries of habitat and population. Establish buffer around known locations to provide for adequate protection of population, and to maintain appropriate habitat and microclimatic conditions. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain GIS layer and associated database for locations of rare or locally endemic taxa. Investigate reproductive biology.

D. Benefits. Mitigation unlikely to improve ratings, but probably required for survival of species in the region, and may reduce risk of extirpation.

I. Species. Rare Cup Fungi (*Pithya vulgaris* (Common Pithya))

II. FEMAT Rating. 0-35-38-28
(collective rating for Rare Cup Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Rare. Despite the name, this is not a common fungus. Early North American reports confused this species with *Pithya cupressina*, a much more common species on Cupressaceae in temperate to subtropical areas. *P. vulgaris* is a saprobe or weak parasite on recently killed twigs of *Abies* at upper elevations (above 3,500 ft. in Oregon). Fruits in late spring or early summer at edges of melting snow.

B. Past Actions. Not a factor in the rating.

C. Species Range. British Columbia, Washington, Idaho, Oregon; rare in Europe (Alps).

D. Non-habitat Factors. Potential global warming or acid rain may affect species indirectly through impact on true firs at higher elevations.

E. Inadequate Information. Distribution and reproductive biology not well known.

F. Features of the Alternative. Primary factor is the extent and protection of high elevation *Abies* stands.

V. **Cumulative Effects Assessment.** Impacts on this species from the harvest of noble fir boughs and trees is a concern.

VI. **Summary.** Ratings reflect present scarcity.

VII. **Mitigation.** Mitigation would improve ratings.

A. **Geographic Extent.** Washington and Oregon.

B. **Specific Habitats.** High elevation *Abies* stands.

C. **Mitigation Measures.** Survey known population to delineate boundaries of habitat and population, and to locate any additional populations. Monitor and protect known sites and establish adequate buffer to maintain appropriate habitat and microclimatic conditions. Develop management guidelines to protect populations from adverse impacts. If information from surveys reveals species to be more common than originally thought, protection of populations may not be essential. Assist private landowners to develop and employ sustainable method of harvesting noble fir boughs without cutting trees. Develop and maintain interagency GIS layer and associated database on locations and information on rare or locally endemic taxa.

D. **Benefits.** Mitigation will improve rating, and reduce risk of extirpation.

I. **Species.** Rare Cup Fungi (*Plectania latahensis*)
(more often as *Sarcosoma latahensis*)

II. **FEMAT Rating.** 0-35-38-28
(collective rating for Rare Cup Fungi group)

III. **Modifications due to changes in Alternative 9.** None

IV. **Explanation of Rating.**

A. **Natural History.** Rare Pacific Northwest endemic. Saprobe on conifer litter - twigs, needles, wood fragments, often fruiting on soil above buried litter. Fruits in spring near snow melt. Inconspicuous and easily overlooked.

B. **Past Actions.** Not a factor in ratings.

C. **Species Range.** Pacific Northwest endemic, Idaho, Washington, Oregon and British Columbia.

D. **Non-habitat Factors.** Increasing air pollution may impact species directly, or more likely indirectly by accumulating in snow, and as it is released into snowmelt water.

Potential global warming may push range northward.

E. Inadequate Information. Need information on specific sites and Distribution within habitat and information on specific sites is not well known. There is no information on reproductive biology, dependence on litter of particular conifers, or response to pollution.

F. Features of the Alternative. The primary factor is management of subalpine and upper montane conifer stands. Most are in federal ownership and removed from harvest, but this species may need site-specific protection from recreational development.

V. Cumulative Effects Assessment. Most known sites in FEMAT region are on federal land, thus ratings are probably not dependent on management of private lands.

VI. Summary. Ratings reflect species scarcity.

VII. Mitigation. Mitigation could improve ratings.

A. Geographic Extent. Upper montane, subalpine forests in Washington and Oregon.

B. Specific Habitats. Adjacent to melting snowfields.

C. Mitigation Measures. Survey known populations to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Monitor populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Investigate protection of type locality. Determine substrate specificity, if any. Study reproductive biology.

D. Benefits. Mitigation may improve rating. Protection of known populations will reduce risk of extirpation.

I. Species. Rare Cup Fungi (*Plectania milleri*)

II. FEMAT Rating. 0-35-38-28
(collective rating for Rare Cup Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Rare Pacific Northwest endemic. Saprobiic on conifer duff.

Fruits late spring adjacent to snow melt. This is one of a group of closely related species in several genera which are black, or blackish, and fruit in late winter or early spring. Some species (e.g. *Pseudoplectania nigrella*, *Plectania melastoma*) are relative common in the this region. Others, including *Plectania milleri*, are rare. Several undescribed species of this group are in the Oregon State University Herbarium.

B. Past Actions. Not a primary factor in rating.

C. Species Range. Pacific Northwest endemic. Known from Idaho, Oregon, British Columbia and probably Washington.

D. Non-habitat Factors. Potential impacts of acid rain and acid deposition in snow are not known. Potential global warming would push range northward, and possibly eliminate species from the range of the northern spotted owl.

E. Inadequate Information. Inadequate information about extent and distribution of populations, reproductive biology and substrate requirements (other than "conifer" duff).

F. Features of the Alternative. In the this region most known sites are at high elevation, and above the level of most harvest activity.

V. Cumulative Effects Assessment. Most sites occur on federal land. Increased harvest from high elevations or increased recreational or seasonal residential development of non-federal high elevation sites could pose a threat.

VI. Summary. Rating reflects perceived scarcity.

VII. Mitigation. Mitigation may improve rating.

A. Geographic Extent. Oregon and Washington.

B. Specific Habitats. Montane, subalpine conifer stands.

C. Mitigation Measures. Survey known populations to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Monitor populations. Survey suitable habitat to find additional populations. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Investigate protection of type locality. Determine substrate specificity, if any. Study reproductive biology.

D. Benefits. Mitigation may improve rating. Protection of known populations will reduce risk of extirpation.

I. Species. Rare Cup Fungi (*Pseudaleuria quinaultiana*)

II. FEMAT Rating. 0-35-38-28
(collective rating for Rare Cup Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Rare saprobe, endemic to the Pacific Northwest. Fruits late spring on wood or soil; presumably growing in conifer wood. Associated with low elevation, late successional conifer forest. Fruiting body is bright red-orange and large enough to be easily visible. This suggests genuine scarcity rather than having been overlooked. Grows in culture, producing no asexual spores. Thus it probably depends on sexual spores from fruitings for dissemination.

B. Past Actions. Past harvest of low elevation, late-successional stands in Olympics and coastal Washington and Oregon probably destroyed prior populations.

C. Species Range. Two sites on Olympic Peninsula; one in Oregon.

D. Non-habitat Factors. Increased recreational use in vicinity of known sites could threaten survival. Effects of potential global warming or increased air pollution not known.

E. Inadequate Information. Inadequate information about possible other sites. Specificity of substrate wood not known. Factors influencing establishment of new populations from ascospores not known. Timing of establishment in relation to forest succession is not known.

F. Features of the Alternative. Primary feature of concern is protection and recruitment of late-successional, low elevation conifer stands on the west side of the Olympics and Coast Range.

V. Cumulative Effects Assessment. Known sites are on federal land, but others may exist on nearby private lands. Management of non-federal lands near coast in Washington and northern Oregon may affect survival.

VI. Summary. Collective rating probably not low enough to reflect extreme scarcity of this endemic. The rating reflects natural history and rarity more than features of the alternatives.

VII. Mitigation. Mitigation will probably not improve rating, but may be required to prevent extirpation.

A. Geographic Extent. Olympic Peninsula, coastal Washington and Oregon.

B. Specific Habitats. Wet, low elevation, late-successional conifer forest.

C. Mitigation Measures. Survey known populations to delineate boundaries of habitat and population, establish buffer around known locations to provide for adequate protection of population. Establish Mycological Special Interest Area to protect known populations and type locality. Monitor populations. Survey suitable habitat to find additional populations. This should be a key species in surveys of spring fruiting fungi in low elevation sites. Develop management guidelines to protect populations from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic taxa, and type localities. Develop more information on substrate preference and reproductive biology.

D. Benefits. Mitigation will probably not improve rating, but may be required for survival. Protection of known populations may reduce risk of extirpation.

I. Species. Jelly Mushroom (*Phlogiotis helvelloides*)

II. FEMAT Rating. 35-30-25-10

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating.

A. Natural History. Saprobe. Occurs on soil (growing on buried woody debris) or directly on woody debris, limited to conifer wood. Uncommon, perhaps rare considering that it is conspicuous but seldom collected. Fruits most years in late fall; it is not an intermittent/rare fruiter. Occasional fruitings said to be large enough to be gathered for food. Also occurs in Europe, where it is regarded as montane or alpine on calcareous soils. In the Pacific Northwest, it occurs in riparian zones, including channels of the smallest seasonal streams.

B. Past Actions. Clearcutting, especially in riparian edges and across seasonal stream beds, has undoubtedly reduced number of populations.

C. Species Range. Occurs in the northeast, northern midwest and northern Rockies but is reported to be most common in the Pacific Northwest. However, current information supports that it is actually uncommon to rare in the Pacific Northwest. Occurs as small, widely-scattered populations. Known populations are about equally distributed on federal and non-federal lands.

D. Non-habitat Factors. Collecting for domestic consumption, scientific, or educational use should be monitored and, if necessary, controlled. No existing evidence that harvest reduces populations, but the potential exists. Potential global warming may further restrict southern edge of its range. This species may be a key species in detecting early effects of acid rain on fungi, because of its occurrence in or adjacent to water courses, and alleged preference for calcareous soils.

E. **Inadequate Information.** Inadequate information about distribution and known populations, reproductive biology, and impact of harvest.

F. **Features of the Alternative.** This species will be affected by management of riparian zones, including small, intermittent streams and upper headwater seeps. In fact, it may not occur outside the riparian zone. It also depends on a supply of large woody debris. It also requires some shading, possibly closed canopy conditions.

V. **Cumulative Effects Assessment.** Half of the known sites occur on non-federal lands. Riparian management of these lands may be crucial to viability of this species.

VI. **Summary.** Rating realistically reflects the status of species.

VII. **Mitigation.** Mitigation can improve the rating of this species.

A. **Geographic Extent.** May occur throughout the region, but there are few known sites.

B. **Specific Habitats.** Riparian, especially in the course of intermittent streams and adjacent to permanent streams.

C. **Mitigation Measures.** Include as a target species in surveys of riparian zones. Species fruits annually in late fall or early winter (Nov.-Dec.), so surveying must be done then. Identify specific populations and protect from unnatural disturbances, including road and trailbuilding, and fish habitat improvement. Provide continuous riparian overstory with at least some coniferous species (Douglas-fir and western hemlock). Monitor known populations. If necessary, limit public access and/or discourage scientific or educational collecting. Small populations, scarcity of local populations and vulnerability of habitat are threats which can be mitigated by district and regional action. Need to establish southern limit of range and monitor to determine effects of climatic change. Investigate reproductive strategy of species and seek methods to encourage natural spread or to seed additional populations.

D. **Benefits.** Mitigation should have a positive effect on existing populations and could result in increased number of populations. Mitigation on federal lands may compensate for probable losses of populations from state and private lands.

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- I. **Species Group.** Branched Coral Fungi
(*Clavulina cinerea*)
(*Clavulina cristata*)
(*Clavulina ornatipes*)

II. **FEMAT Rating.** 65-35-0-0

(collective rating for Branched Coral Fungi group)

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Widespread in FEMAT region, especially northward. Associated with late-successional forests and with well-developed litter layer, but reappear soon following canopy closure in younger stands.

B. Past Actions. Harvest of old-growth reduced populations but species are not threatened.

C. Species Range. FEMAT region and elsewhere.

D. Non-habitat Factors. Not commercially harvested. Impacts of potential global warming might displace population northward. Impacts of atmospheric pollution most likely would act indirectly by changes in dominant trees.

E. Inadequate Information. Inadequate information on reproductive biology.

F. Features of the Alternative. Retention and recruitment of late-successional stands probably adequate to sustain these species.

V. Cumulative Effects Assessment. Management of non-federal lands not crucial to survival of these species on federal lands.

VI. Summary. Ratings reflect adequate abundance on protected federal lands.

VII. Mitigation. Mitigation not required for survival. Include these species in general surveys of fleshy fungi. Monitor southern populations as indicators of global warming.

VIII. Benefits. Mitigation will not improve ratings.

I. Species. Cauliflower Mushroom (*Sparassis crispa*)

II. FEMAT Rating. 67-25-5-3

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. A large "mushroom" (up to 50 lb. each) dependent on very large trees, conifers, primarily Douglas-fir, in FEMAT region. Although associated

with trees that host ectomycorrhizal fungi, *Sparassis* is a root parasite causing a rot of large roots, but rarely if ever killing its host. Edible and very choice. Since it is also conspicuous, a large proportion of existing fruiting bodies get harvested. Even though it is relatively uncommon, it is harvested and marketed commercially. An established mycelium commonly fruits annually at the base of the same large tree. Appears to continue to fruit from roots of largest trees for several years following cutting if stand is not clearcut. Characteristic of low to mid-elevation sites. There is some debate on the taxonomy of this species. The names *S. crispa*, *S. radicata*, and others have been applied in conflicting senses. There may be only a single variable North American species. More likely there is an eastern species, a western species, and one or more rare local species.

B. Past Actions. Extensive harvest of low elevation old-growth has resulted in a marked decline of this species. This was a consideration in the original ratings.

C. Species Range. Occurs throughout FEMAT area where suitable trees remain. Also in Rockies, southwest, east, Europe, Asia. If there is more than one species, then ours may be endemic.

D. Non-habitat Factors. Commercial and domestic harvest for food reduces the number of fruiting bodies available to produce spores for dissemination. Also reduces availability as food for non-human vertebrates. Effects of atmospheric factors likely act through impacts on host trees.

E. Inadequate Information. Taxonomy needs attention to determine whether our species is endemic or a local population of a widespread species. Monitoring commercial harvest and assembling region-wide data should provide better information on distribution. Need better information on destructiveness to host, if any, and on reproductive strategy of species.

F. Features of the Alternative. Primary feature is retention of stands >200 years.

V. Cumulative Effects Assessment. Continued heavy commercial and domestic harvest of *Sparassis* could have an impact. This species and *Cantharellus cibarius* should be key species in monitoring impacts of harvest. Reduction of suitable habitat on low elevation state and private land is not likely to have much effect, simply because so little remains, and the species occurs on many federal sites.

VI. Summary. Ratings reflect close association of species with very old trees, which are not soon replaced, and concern for possible impact of continued heavy harvest of fruiting bodies.

VII. Mitigation. If research determines that harvest reduces populations, then control of harvest would increase ratings. It seems unlikely that other mitigation could improve ratings, except in the very long run (>100 yr) because of the difficulty in producing very old trees quickly.

A. Geographic Extent. Throughout Pacific Northwest, northern California.

B. Specific Habitats: Mitigation depends on management of the matrix. Species requires very large old conifers, mostly Douglas-fir, as hosts. Single scattered leave trees probably not adequate to maintain suitable environment (humidity, humus) at ground level.

C. Mitigation Measures: Mitigation should focus on creation and retention of suitable habitat in the matrix. Clumped green tree retention is beneficial to this species. Leave trees need to be older than 100 years, as well as to be located in closed canopy stands. Survey and inventory for this species to determine extent of distribution, abundance, habitat and ecology. Conduct research and monitoring on impact of harvest, and determine appropriate management actions to maintain sustainability. Additional research is needed to determine damage to host and method of establishment of infection.

D. Benefits. Unlikely that mitigation will improve ratings, except in very long term. Not implementing mitigation actions may decrease viability of this species in certain parts of its range.

I. Species Group. Parasitic Fungi

(*Asterophora lycoperdoides*)
(*Asterophora parasitica*)
(*Collybia racemosa*)
(*Cordyceps capitata*)
(*Cordyceps ophioglossoides*)
(*Hypomyces luteovirens*)

II. FEMAT Rating. 40-30-25-5
(collective rating for Parasitic Fungi group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of these species and impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. All of these species occur on fruit bodies or the remains of fruit bodies of other fungi, therefore they are dependent on one or more host species for their growth and reproduction. They are found in late-successional forests. Most of them are infrequent or rare but may be locally common where the host is readily available. Fruit in the late summer, fall and winter depending on geographic location.

B. Past Actions. Unknown. However, populations of certain species, for example, *Collybia racemosa*, may have been reduced by extensive removal of late-successional

coastal forests.

C. Species Range. These species likely occur throughout the range of the northern spotted owl in late-successional forests. However, known locations are few for most of them.

D. Non-habitat Factors. Air pollution could cause decline since the hosts primarily are ectomycorrhizal fungi.

E. Inadequate Information. General distribution known but precise distributions and details of ecology are poorly known.

F. Features of Alternatives. Overall acreage and distribution of late successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species. Late-successional forests should be maintained across the landscape to promote growth and reproduction of parasite and host species. Manage matrix areas to provide for a well-distributed network of late-successional forests.

V. Cumulative Effects of Assessment. Management practices on federal lands likely will be helpful once the distributions of the species are known. In coastal areas management practices on non-federal lands could influence continuity of species across the landscape; for example, *Collybia racemosa*. The potential effects of global warming cannot be determined, however, air pollution could lead to decline by having a negative effect on hosts. Risk could be changed through mitigation on federal lands.

VI. Summary. Ratings reflect that the species are uncommon to rare and that they and their hosts require late-successional forests for growth and reproduction. Parasitic fungi that occur on other macrofungi (mushrooms, etc.) are relatively uncommon. The Pacific Northwest has a disproportionately large number of these species. Even more intriguing is the recent discovery of a new genus of parasitic mushrooms in old growth forests on the Olympic Peninsula. It has been found in two separate locations.

VII. Mitigation. Mitigation will protect known populations and improve ratings by assuring that suitable habitats are provided for these species.

A. Geographic Extent. The species are likely widely distributed in the range of the northern spotted owl.

B. Specific Habitat. Occur in late-successional forests with host species.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations and determine if management is necessary to protect known populations. Evaluate species distribution on federal lands to determine if populations are isolated or face extirpation, if so, look at non-federal lands as a way of providing connectivity

between populations. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance. Protect known populations of rare species by providing a buffer that is adequate to maintain habitat and microclimate conditions.

D. Benefits. Mitigations likely would change the ratings of these species. Most importantly it will provide baseline information on their distribution, frequency, and productivity as well as their reproduction and ecology.

I. Species Group. Club Coral Fungi (*Clavariadelphus* spp.)

(*Clavariadelphus ligula*)
(*Clavariadelphus pistilaris*)
(*Clavariadelphus truncatus*)
(*Clavariadelphus borealis*)
(*Clavariadelphus lovejoyae*)
(*Clavariadelphus sachalinensis*)
(*Clavariadelphus subfastigiatus*)

II. FEMAT Rating. 55-25-15-5
(collective rating for Club Coral Fungi group)

III. Modifications due to changes in Alternative 9. Shortened rotations in California will decrease available and potential future habitat.

IV. Explanation of Rating.

A. Natural History. The genus *Clavariadelphus* includes three widespread species: *C. ligula*, *C. pistilaris*, and *C. truncatus*, all of which occur in the FEMAT region and are associated with late-successional forest. In addition, there are other less well known species in the Pacific Northwest, such as: *C. borealis*, *C. lovejoyae*, *C. sachalinensis*, *C. subfastigiatus*, and possibly others, including likely endemics. All of these species are limited to late-successional forests, in some cases (*C. pistilaris*) in either hardwood or conifer or mixed forests; in other cases only in conifer forests.

All require cool or cold, moist forests, and increase in frequency with increasing elevation and latitude. Not that common in this region, although conspicuous because they are relatively large, brightly colored, and unusual in shape. It is possible that they may be more common further north (British Columbia and Alaska) or in northern Europe. All are probably ectomycorrhizal. All require a well-developed humus layer and are not found without it, regardless of the age of the stand. Populations are limited in extent (a few meters across) and widely scattered; probably averaging no more than one or two populations per section even under favorable conditions. Fruiting may consist of a single basidiocarp, but more often there are several (3-6), rarely many more. The taxonomy of the

less common species needs additional study and next to nothing is known about their reproductive biology.

B. Past Actions. Clearcutting mature forest has undoubtedly reduced the number of populations by removing habitat. Past actions were a concern in the original rating.

C. Species Range. Pacific Northwest, north into British Columbia and Alaska, Midwest and eastern North America, northern Europe.

D. Non-habitat Factors. Although not subject to commercial harvest, they are occasionally gathered for food by recreational pickers. There is no evidence if this is a threat to any of the species. If these species are threatened by atmospheric factors (e.g. pollution, climate change) it seems likely that this would result indirectly through impacts on the overstory trees.

E. Inadequate Information. Species taxonomy and distribution not well known. Need studies of reproductive biology.

F. Features of the Alternative. Primary feature is retention or creation of late-successional forest with a well-developed litter layer.

V. Cumulative Effects Assessment. Loss of suitable habitat (late successional forest with well-developed litter layer) from state and private lands will result in further reduction of range. In the case of less well known species (see above), especially if some are indeed endemic, this may result in extirpation or extinction.

VI. Summary. Ratings reflect limited known distributions, dependence on mature forest, uncertainty about number and distribution of rare endemics.

VII. Mitigation. Mitigation, especially in management of matrix, could improve ratings.

A. Geographic Extent. Throughout the range of the northern spotted owl.

B. Specific Habitats. Mitigation depends on management of the matrix. To some extent it may be species-specific, but all require late-successional forest with a well developed litter layer. All are presumed ectomycorrhizal, some with conifers (Pinaceae), others with either conifers or hardwoods (Fagaceae).

C. Mitigation Measures. Retain or create suitable habitat. Treatment of leave trees and areas in matrix is most critical. Scattered leave trees will not create adequate litter layer for these species. There is an urgent need to update taxonomy to determine how many rare endemic species are included in this complex. Include this genus as one of critical concern in general surveys of ectomycorrhizal mushrooms, to develop more information on distribution, abundance, habitat and ecology. Specific sites for rare endemics should be managed to protect the viability of the population, including an adequate buffer around the population to maintain suitable habitat and microclimatic conditions. Develop management guidelines to

protect rare species from adverse impacts. Develop and maintain interagency GIS layer and associated database for locations of rare or locally endemic species.

D. Benefits. Favorable management of matrix will improve ratings for some, probably all, species. Further determination of distribution of three widespread species may remove one or more from threat of extirpation. Protection of known populations of the rarer species will reduce risk of extirpation.

I. Species Group. Moss-Dwelling Mushrooms

(*Cyphellostereum laeve*)
(*Galerina atkinsoniana*)
(*Galerina cerina*)
(*Galerina heterocystis*)
(*Galerina sphagnicola*)
(*Galerina vittaeformis*)
(*Rickenella setipes*)

II. FEMAT Rating. 40-35-25-0
(collective rating for Moss-Dwelling Mushroom group)

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas in California may reduce suitable or potential habitat for some of these species. Management of matrix areas will influence the distribution, frequency and reproduction of these species and impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. Small fruit bodies, closely associated with mosses (parasitic, etc.) and dependent on them. Often found in late-successional forests, especially in moist habitats; some also occurring in other habitats. Fruit bodies produced primarily during the summer and fall season but may fruit during other times of the year depending on site and geographic location. *Galerina cerina* likely the host for a new genus of parasitic mushroom currently being described from the Olympic Peninsula.

B. Past Actions. Late-successional habitats for these species have been reduced by logging but these are widely distributed and not at risk of isolation or extirpation.

C. Species Range. Distributed across the Pacific Northwest in suitable habitats.

D. Non-habitat Factors. Air pollution and global climate change could cause a decline in these species as they are closely associated with mosses.

E. Inadequate Information. Details of ecology, life history and reproduction are

lacking. Specific distributions have not been mapped.

F. Features of Alternatives. Overall acreage and distribution of late-successional forests, and management of the matrix were important features of the alternatives that influenced the original ratings of these species.

V. Cumulative Effects of Assessment. These species are widely distributed on all lands, and logging of late-successional forests has probably modified their distributions. Management of non-federal lands could be important in some areas, *e.g.*, coastal forests, to provide connectivity between populations.

VI. Summary. Ratings reflect concerns that adequate habitat be provided for these species in all reserve and matrix areas. Details of distribution, reproduction and habitat requirements are needed.

VII. Mitigation. Will improve ratings.

A. Geographic Extent. Distributed across the Pacific Northwest in suitable habitats.

B. Specific Habitat. Characteristic of moist, late-successional forests; also occurring elsewhere in suitable habitats. Closely associated with mosses and dependent on them for growth and reproduction.

C. Mitigation Measures. Include these species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocations. Develop database of known locations. Determine if management is necessary to protect known populations. Maintain and develop late-successional forests with abundant component of terrestrial and log dwelling bryophytes. Within harvest areas in the matrix, aggregate leave trees to provide adequate interior microclimate and duff layer, minimize site disturbance. Maintain amounts of large coarse woody debris representative of natural stand conditions.

D. Benefits. Mitigation will improve rating and provide needed information on the distribution, frequency, general ecology, habitat requirements and reproduction of these species.

I. Species. Mushroom Lichen (*Phytoconis ericetorum*
(syn. *Omphalina ericetorum*)

II. FEMAT Rating. 80-20-0-0

III. Modifications due to changes in Alternative 9. Shortened rotations in California may threaten local populations of an already uncommon species at the southern limit of its

range.

IV. Explanation of Rating.

A. Natural History. A lichenized mushroom which grows in association with an alga, *Botryodina*, on dead, decorticated wood, often in association with mosses. Requires light to support growth, unlike related saprobic species; therefore more common at edges of openings. However, also requires large woody debris and probably alternate high and low moisture.

B. Past Actions. Uncommon in large clearcuts and closed canopy stands. Road and trail building may have increased populations; extensive clearcutting has probably reduced populations.

C. Species Range. Widespread on the westside from the coast to the subalpine zone. Uncommon in California becoming more common northward, and abundant in the arctic. Also occurs in Europe.

D. Non-habitat Factors. Air quality is probably less important than for many lichens. Potential global warming may threaten California populations.

E. Inadequate Information. Small and inconspicuous, therefore often overlooked and mostly not recognized as a lichen. Method, rate, and range of dispersal are not known. Response to fire is not known, but is probably adverse.

F. Features of the Alternative. Old-growth, 400 plus years, patchy enough to support species. Survival in matrix may depend on specifics of management of leave trees and large woody debris, therefore difficult to predict from level of detail in plan. Stream buffers probably adequate habitat where not too moist.

V. Cumulative Effects Assessment. Species is well represented on federal lands. Management of non-federal lands will increase or decrease whole population, but probably not threaten extirpation.

VI. Summary. Ratings are not likely to change.

VII. Mitigation. Mitigation not required for survival.

A. Geographic Extent. Concentrate survey and monitoring in California. Species is uncommon there and potentially subject to impact of global warming.

B. Specific Habitats. In Oregon and Washington concentrate monitoring in the matrix. This will be a key species in determining the success or failure of specific arrangements of leave trees and logs.

C. Mitigation Measures. (Mitigation not required for survival of species) Survey and monitor. Because the crustose thallus of this lichen is difficult to distinguish, it is appropriate to survey for it using methods suitable for mushrooms. This

mushroom fruits over broader range of wet season (fall, winter and spring) than most mushrooms. Include this species in surveys of key mushrooms, since it is easily recognized, fruits over a long season, and probably occupies, and is an indicator for, a special niche. Other measures which will benefit this species include enhancing stand patchiness and providing sufficient amounts of coarse woody debris.

D. Benefits. Mitigation will not increase ratings. However, it will enhance protection of local populations.

I. Species. Coral Fungus (*Clavicornia avellanea* (syn. *C. piperata*))

II. FEMAT Rating. Not rated, recommend rating of 40-35-15-10

III. Modifications due to changes in Alternative 9. Removal of the 180-year rotation in matrix areas of California may reduce suitable or potential habitat for this species. Management of matrix areas will influence the distribution, frequency and reproduction of this species and its relatives and could impact them in certain parts of their range.

IV. Explanation of Rating.

A. Natural History. Late-successional forests, low to mid-elevations, in moist habitats on coarse woody debris, usually large diameter partially decayed logs. Fruits in late summer to fall depending on geographic location.

B. Past Actions. Habitat for this species has been reduced by logging.

C. Species Range. Few records available, probably widely distributed in the Pacific Northwest in suitable habitats. Infrequent to rare.

D. Non-habitat Factors. Air pollution could result in the decline of this species.

E. Inadequate Information. The overall distribution of this species in the Pacific Northwest is not known. Information on reproduction, general ecology and habitat requirements is limited.

F. Features of Alternatives. Overall acreage and distribution of late-successional forests, and management of the matrix were important features of the alternatives that influenced the ratings of this species. Management of matrix areas is important for developing future habitats for this species. Logs should be provided in moist habitats with natural numbers and patterns of distribution.

V. Cumulative Effects of Assessment. There are too few reports of this species to determine its distribution on federal and non-federal lands. Its distribution and frequency

have been impacted by logging low and mid-elevation forests.

VI. Summary. This species was not rated in the original FEMAT assessment. Additional information available since then supports the recommended rating listed above. This rating reflects the rareness of the species and the lack of knowledge of its distribution, frequency, general ecology, habitat requirements and reproduction. Potential effects of air pollution and global climate change cannot be accurately predicted.

VII. Mitigation. Will improve knowledge of species and rating.

A. Geographic Extent. Few records available, probably widely distributed in the Pacific Northwest. Infrequent to rare.

B. Specific Habitat. Late-successional forests, low to mid-elevations, in moist habitats on coarse woody debris, usually large diameter partially decayed logs.

C. Mitigation Measures. Include this species in the general regional inventory of fungi to determine distribution, abundance, habitat requirements and ecology. Determine distribution of populations relative to late-successional reserves and matrix allocation. Develop database of known locations. Determine if management is necessary to protect known populations. If so, protect known populations by providing a buffer zone adequate to maintain integrity of habitat and microclimate of the site. Do similar surveys on non-federal lands in areas where late-successional forest are not common on federal lands, *e.g.*, coastal forests. Map and monitor populations and determine details of habitat requirements. Management of matrix areas adjacent to known populations should be toward establishing late-successional forests with natural patterns and numbers of logs. Within harvest areas of the matrix, maintain amounts of coarse woody debris that are representative of the natural stand conditions, aggregate leave trees, and minimize site disturbance.

D. Benefits. Mitigation will provide baseline data on the overall distribution and habitat requirements and will improve ratings. Protection of known populations will reduce risk of extirpation.

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I. **Species Group.** Rare Forage Lichen (arboreal) (*Bryoria tortuosa*)

II. **FEMAT Rating.** 0-6-75-19

III. **Modifications due to changes in Alternative 9.** None

IV. **Explanation of Rating.**

A. **Natural History.** This is the only species rated in this group at this time because other species in the category lacked sufficient information to rate them. This species occurs most frequently in wet moisture regimes on oaks, pines and deciduous shrubs, but also occurs on conifers along the coast and inland at low elevations. This species and other forage lichens are eaten by forest mammals.

B. **Past Actions.** Most of the suitable habitat in the coast Ranges and in the Olympics has been harvested.

C. **Species Range.** Coastal and mesic, low to mid elevation sites from central California to British Columbia. This species has been collected infrequently in northern California (near Mt. Shasta), and in coastal and wet valley locations in Oregon and Washington. An extensive search of Oregon, Washington and British Columbia herbaria (Neitlich et al. 1993) revealed 11 locations for this species in the study area. Only one herbarium record was found from northern California (Shasta Co.), but Brodo and Hawksworth (1977) report eight other specimens from coastal or montane northern California. Five locations were found in Oregon: 3 in the Willamette Valley (Lane Co.), and two in southwest Oregon, near Cave Junction (Josephine Co.) and Eagle Point (Jackson Co.) Brodo and Hawksworth (1977) report 3 additional specimens from northwest Oregon. 12 locations have been identified in Washington (Brodo and Hawksworth 1977; Neitlich et al. 1993). These include Deception Pass State Park on Whidby Island (Island Co.), Cypress Island (Skagit Co.), Fidalgo Island (Skagit Co.), the east-central Cascades (Kittitas Co.) and south eastern Washington (Klickitat Co.) Brodo and Hawksworth (1977) report other specimens from the Mt. Rainier National Park/Mt. Baker-Snoqualmie National Forest area.

D. **Non-habitat Factors.** This species is sensitive to air pollutants.

E. **Inadequate Information.** Species distributions are poorly known. Species was first described in 1977.

F. **Features of the Alternative.** This species, like other conifer canopy epiphytes, requires the retention of groups of standing trees to maintain suitable microclimate and for the dispersal of the species. Therefore, the late-successional reserves will provide habitat for this species group if the species occurs within the reserves. Only one of the three known sites for this species occurs in such a reserve. The Riparian Reserves do not provide suitable habitat for this species group. Some of the areas

protected for marbled murrelets may be beneficial for this lichen species group.

V. Cumulative Effects Assessment. Due to the accessibility and rapid growth rates of lower elevation forests most suitable sites for this species have been and will continue to be harvested at rather short rotation ages. Increased human population growth at the lower elevations as well as degraded air quality pose risks to the viability of this species.

VI. Summary. Ratings reflect the optimism that other localities of this species may exist and that those stands will be protected in the reserve system. Without this occurring the prospect for this species with only one protected site is poor.

VII. Mitigation. Mitigation may improve the ratings for this species.

A. Geographic Extent. Low elevation forests along the coast and in the Washington lowlands.

B. Specific Habitats. Low elevation, mesic, mixed deciduous-coniferous forest habitats, most commonly pine and oak.

C. Mitigation Measures. Inventory to identify new populations for this species. Sites listed by Neitlich et al. (1993) and Brodo and Hawksworth (1977) should be revisited for assessment and monitoring. Protection of key sites for the species by designation of Botanical Special Interest Areas or Areas of Critical Environmental Concern are important mitigation for this species. Protection buffers should be established around occurrences of this species in the managed late-successional areas and in the matrix. A study of this species' biology should be conducted to provide better direction in determining management guidelines. A conservation strategy should be developed for this species on an interagency basis.

The State Natural Heritage Programs should assist with this coordination and store the information in their database.

D. Benefits. Protection of known sites will allow the further study of the species and maintain existing populations on federal lands. Forage lichens supply the majority of the northern flying squirrel's (*Glaucomys sabrinus*) winter diet, as well as providing forage for ungulates, other forest mammals, and invertebrates (Maser, 1986). The flying squirrel, in turn, represents a significant portion of the spotted owl's diet.

-
- I. Species Group.** Common Oceanic Influenced Lichens (4 species)
Cetraria californica
Heterodermia leucomelos
Loxospora sp nov. "*corallifera*" (Brodo in edit)

Pyrrhospora quernei

- II. FEMAT Rating. 5-40-46-9
- III. Modifications due to changes in Alternative 9. None
- IV. Explanation of Rating.

A. **Natural History.** Four species are treated in this group. They are restricted to old-growth stands of conifers on the immediate coast. They are never abundant but are more widespread than the rare oceanic influenced species. These species occur on peninsulas, headlands and low elevation forests along the coast. Frequent fog along the coast, combined with moderate temperatures, create a unique environment for these lichens. These species are found on conifers in the Pacific Northwest. *Heterodermia leucomelos* occurs on other substrates in the tropics.

B. **Past Actions.** Most of the suitable habitat in the coast ranges and in the Olympics has been harvested.

C. **Species Range.** *Cetraria californica* is endemic to the west coast of North America, ranging from San Luis Obispo, California to southeast Alaska. It has been documented at 13 coastal or near-coast sites in Oregon and four in Washington. Throughout the range it is most common in scrubby dune habitats on *Pinus contorta*.

Heterodermia leucomelous is tropical in most of its distribution except for the coast of the Pacific Northwest. It has been documented at five sites in the study area. In California, it is known from Vista Point in Humboldt County. In Oregon, it is known from Cape Arago (Coos Co), Cape Blanco (Curry Co.), Cape Sebastian (Curry Co.), and Cape Lookout (Tillamook Co.). In each location, it has been found on large *Picea sitchensis* on these forested headlands.

Loxospora corallifera (Brodo in edit) is fairly common on conifers along the coastal forests.

Pyrrhospora quernei occurs very discontinuously from the Santa Cruz Islands in California to the San Juan Islands in Washington. This species has been found at four locations in the study area, all along the immediate coast. In Oregon, it has been documented at Cape Blanco (Curry Co.) and at Waldport (Lincoln Co.). In Washington, it has been documented on San Juan Island (San Juan Co.) and Sequim (Clallam Co.). The Oregon specimens were collected on *Picea sitchensis*, while Washington specimens were growing on *Quercus garryana*.

D. **Non-habitat Factors.** These species are sensitive to air pollutants.

E. **Inadequate Information.** Species distributions are poorly known. One of the species is still undescribed.

F. Features of the Alternative. These species, like other conifer canopy epiphytes, require the retention of groups of standing trees to maintain suitable microclimate and to aid dispersal of the species. Therefore, the late-successional reserves will provide habitat for this species group if the species occur within the reserves. The Riparian Reserves do not provide suitable habitat for this species group. Some of the areas protected for marbled murrelets may be beneficial for this lichen species group.

V. Cumulative Effects Assessment. Due to the accessibility and rapid growth rates of lower elevation forests most suitable sites for these species have been and will continue to be harvested at rather short rotation ages. Increased human population growth at the lower elevations as well as degraded air quality pose risks to the viability of these species.

VI. Summary. Ratings reflect the optimism that other localities of these species may exist and that those stands will be protected in the reserve system. Without these occurring the prospect for these species with only one protected site is poor.

VII. Mitigation. Mitigation may improve the ratings for this species.

A. Geographic Extent. Coastal areas.

B. Specific Habitats. Low elevation forests along the immediate coast (1-2 miles).

C. Mitigation Measures. A study of these species' biology should be conducted to provide better direction in determining management guidelines. A conservation strategy should be developed for these species on an interagency basis.

Recreational facilities along the coast should minimize degradation of botanical resources. Off-highway vehicles (OHVs) that disperse exotic vascular plant species should be limited from some areas, including winter travel. Driftwood, which supports other oceanic influenced lichen species not listed here, should be protected from collection and burning.

Coordination between state and private sectors to inventory, evaluate and establish sites for conservation of these species is necessary. Acquisition of sites along the coast containing any of these species should be pursued. This group of lichens rated lower than any other group.

D. Benefits. Protection of known sites will preserve this element of biodiversity on the coast. It would also permit the further study of the species and maintain existing populations on federal lands.

I. Species Group. Rare Leafy (arboreal) Lichens
Hypogymnia duplicata

Tholurna dissimilis

- II. FEMAT Rating. 0-20-63-17
- III. Modifications due to changes in Alternative 9. None
- IV. Explanation of Rating.

A. Natural History. Two species are treated in this group. *Hypogymnia duplicata* is a species found in coastal low elevation to wet windswept sites and is more common northward into British Columbia and Alaska. It occurs in areas with frequent and large quantities of fog and rainfall.

Tholurna dissimilis is found on windswept, stunted trees in the montane subalpine fog zone, and in the upper canopy of old-growth Douglas-fir trees (Pike 1972, Otto 1983). It is rare in the study area, but occurs with increasing frequency in British Columbia, Northwest Territories and Alaska. Known collections in the study area (Neitlich et al. 1993) are most often from slow-growing, stunted trees at timberline (e.g. *Abies lasiocarpa*, *Tsuga mertensiana*). It has also been collected on an exposed, windy site in the Columbia Gorge.

B. Past Actions. Most of the suitable habitat in the coast ranges and in the Olympics has been harvested.

C. Species Range. *Hypogymnia duplicata*: Coastal and maritime low elevation sites in the Pacific Northwest and Alaska. There are four known sites in the study area. In Oregon, it has been recorded at Larch (Multnomah Co.) and Saddle Mountains (Clatsop Co.) in the coast range. In Washington, it has been recorded in the Nooksack River area (Skagit Co.) and Sulfur Creek Lava Flow (Whatcom Co.). This species is listed as threatened in Oregon by the State Natural Heritage Program.

Tholurna dissimilis: It is known from the montane areas of the Pacific Northwest. There are nine known sites in the study area (Pike 1972; Otto 1983; Neitlich et al. 1993). It has been collected in Oregon on the summit of Iron Mountain (Linn Co.). It has been found at eight high elevation (>1750 m) sites in Washington including Mt. Rainier, two ridgetops in the Olympics (Clallam Co.) and four ridgetops near Mt. Baker (North Cascades National Park/Mt. Baker National Forest; Whatcom Co.). It has also been found in a windy, exposed site in the Columbia Gorge (Skamania Co.)

D. Non-habitat Factors. These species are sensitive to air pollutants.

E. Inadequate Information. These species distributions are fairly well documented but may need additional inventories at low elevations where they have not been recorded but may occur given the documented natural history.

F. Features of the Alternative. Like many other conifer canopy epiphytes, these species require the retention of groups of standing trees to maintain a hyper-mesic microclimate. Scattered leave-tree retention may adversely affect this microclimate, and therefore, the ability of the species to survive, reproduce and disperse. The late-successional reserves will provide habitat for this species group if the species occurs within the reserves. The Riparian Reserves do not provide suitable habitat for these species. The areas protected for marbled murrelets may be beneficial for these lichen species.

V. **Cumulative Effects Assessment.** The dynamics of fog in young forested stands may not provide suitable conditions for the growth of these species. Increased human population growth at the lower elevations as well as degraded air quality pose risks to the viability of these species.

VI. **Summary.** Ratings reflect the optimism that other localities of these species may exist that are not documented at this time and that those stands will be protected in the late-successional reserve system. These species despite their small size have been well studied relative to many other lichen species. The specific habitat preferences for both species are documented and their distributions delineated.

VII. **Mitigation.** Mitigation could improve the ratings for these species.

A. **Geographic Extent.** Throughout the Pacific Northwest.

B. **Specific Habitats.** Montane and subalpine fog zone habitats.

C. **Mitigation Measures.** Inventory coastal montane forests, bald mountain tops with stunted windswept trees for these species to identify new populations and survey before permitting major actions. Protection of key sites for the species by designation of Botanical Special Interest Areas or Areas of Critical Environmental Concern are important mitigation for them. Protection buffers should be established around occurrences of these species in the managed late-successional areas and in the matrix. A study of these species' biology should be conducted to provide better direction in determining the optional width of buffers and other management guidelines. A conservation strategy should be developed for these species on an interagency basis. The State Natural Heritage Programs should assist with this coordination and store the information in their database.

Green trees on ridgelines should be retained to optimize lichen dispersal and interception of fog for these species is critical. This retention pattern on the landscape mimics the retention patterns by natural fire. Half of the naturally occurring trees on a ridgeline should be retained. Generally retention trees should be selected that are the big, old trees with large lateral branches and trees that have emergent crowns. However, for these lichen species slow-growing, wind-firm, trees of any size occurring on the ridgeline are suitable retention trees.

A more thorough search for *Tholuna dissimilis* in low elevation, exposed sites (e.g. exposed ridgetop canopies, or canopies in cold air drainages) may reveal additional locations.

D. **Benefits.** Protection of known sites will maintain existing populations on federal lands. These rare leafy lichens increase forest biodiversity and provide habitat for invertebrates.

I. **Species Group.** Rare Nitrogen-fixing Lichens

Dendriscocaulon intricatulum

Lobaria hallii

Lobaria linita

Nephroma occultum

Pannaria rubiginosa

Pseudocyphellaria rainierensis

- II. FEMAT Rating. 0-20-52-28
- III. Modifications due to changes in Alternative 9. None
- IV. Explanation of Rating.

A. **Natural History.** Six species are treated in this group. *Pseudocyphellaria rainierensis* and *Nephroma occultum* are Pacific Northwest endemics which occur almost exclusively in stands greater than 200 years old (McCune 1993, Neitlich 1993). *Dendroscopula intricatulum*, *Lobaria hallii*, *Lobaria linita*, and *Pannaria rubiginosa* have somewhat broader distributions and habitat requirements but are most common in the Pacific Northwest in a variety of late successional forest types (Pike 1972, Pike 1973, Goward 1992, McCune 1993). Four of these species (excepting *L. hallii* and *P. rainierensis*) are documented from less than ten sites. Five of these species tend to occur at in low- to mid-elevation forests; *L. linita*'s range in the study area represents the far southern reaches of its boreal range, and tends to occur in middle to upper elevation forests (500-1900m). These species generally do not colonize a forested stand until it is over 200 years old, when the texture of the bark is suitably rough and the microclimate is ameliorated by the open, multilayered canopy. Many of these lichen species are hindered from colonization into younger stands by dispersal limitations (Esseen et al. 1981). Most of the known sites for these species are forests more than 350 years old with a high index of ecological continuity (Broad 1989).

B. **Past Actions.** Much of the suitable habitat has been harvested.

C. **Species Range.** *Pseudocyphellaria rainierensis* and *Nephroma occultum* are endemic to the Pacific Northwest of North America; the other four also occur elsewhere in temperate to boreal North America, and in Europe.

Nephroma occultum is known from only five sites in the United States. The type collection and most other collections come from the H. J. Andrews Experimental Forest, Willamette National Forest, (Lane Co.) Oregon. It has been collected throughout the Andrews and at two other sites on the Willamette--the Delta campground, and Middle Santiam Wilderness Area (Linn Co.) It has been collected in Washington at Government Mineral Springs (Skamania), Mt. Rainier (Pierce), and the Sulfur Creek Lava Flow (Whatcom). It occurs at several locations in British Columbia (Goward 1992). All but one known occurrence have been reported from pristine, old growth forest of approximately 400 years of age (Neitlich et al. 1993; Neitlich, 1993). This species is listed as endangered by the Oregon Natural Heritage Program.

Pseudocyphellaria rainierensis is known from five old-growth forest sites in Oregon and 11 sites in Washington. Oregon locations have been four hyper-mesic Cascadian old growth forests and one maritime coastal forest. Cascadian locations (all Willamette National Forest) are the H. J. Andrews Experimental Forest (Lane Co.), Middle Santiam Wilderness Area (Linn Co.), Shaffer Creek (Linn Co.), and Koosah Falls (Linn Co.). A sole coastal occurrence has been found at Cape Perpetua (Lincoln Co.). This occurrence represents the southernmost record for the species. Eleven records have been reported from Washington. Distribution ranges from the Columbia Gorge (Skamania Co.) in the south to Mt. Baker National Forest and Olympic National Park in the north. No specimens have been reported in B.C. (Neitlich et al. 1993).

Dendroscopula intricatulum is known from Sulfur Creek Lava Flow on the Mt. Baker-Snoqualmie National Forest in Washington. This species has also been found infrequently in

British Columbia and southeast Alaska. It occurs in wet boreal and riparian forests.

Lobaria hallii is known from many low- to mid-elevation forests with a wet and/or fog driven moisture regime. It occurs most abundantly on large diameter hardwoods in riparian areas and other wetlands, e.g., *Acer macrophyllum*, *Quercus* spp., *Fraxinus latifolia*, *Populus trichocarpa*, *Salix* spp., and deciduous shrubs. It ranges from northern Alaska to central coastal California (San Mateo Co.).

Lobaria linita grows with moderate frequency throughout coastal southeast Alaska and British Columbia, and has been reported from Montana, Idaho and Norway. It is known from 10 sites in Washington and one in Oregon. The Oregon specimen is located in old growth Douglas-fir forest at the Little Sink Research Natural Area (Polk Co.). Washington sites include Sulfur Creek Lava Flow (Whatcom Co.), several sites in the Mt. Baker National Forest and North Cascades National Park (Whatcom Co.), several sites on the Olympic Peninsula (Jefferson and Clallam Co.'s), and King and Kittitas counties. It grows epiphytically on trees and tundra low shrubs, and over boulders and mosses.

Rare throughout its range, *Pannaria rubiginosa* has been reported very discontinuously from British Columbia to North Carolina. It has been reported from only two locations in the study area: Fisherman's Bend, a Bureau of Land Management recreational site near Salem, Oregon; and the Seattle Park area of Mt. Rainier (Pierce Co., Washington).

D. Non-habitat Factors. This group of species is very sensitive to air pollutants (Hawksworth and Hill 1984).

E. Inadequate Information. These are fairly large or distinct species so they are easy to identify and their distributions are fairly well known relative to other lichen species. Additional inventories and research are needed to better direct active management.

F. Features of the Alternative. These species, like other conifer canopy epiphytes, require the retention of aggregates of standing trees to maintain suitable microclimate and provide for the dispersal of the species. Therefore, the late-successional reserves will provide habitat for this species group if the species occur within the reserves. The Riparian Reserves also provide suitable habitat for these species.

V. Cumulative Effects Assessment. The stand dynamics and microclimate in young forested stands may not provide suitable conditions for the growth of these species. Therefore, short rotations and adaptive management that may help other old-growth associated plants or animals may not be beneficial to these species. Increased human population growth at the lower elevations as well as degraded air quality pose risks to the viability of these species. Some of these species may already have been reduced to very low population numbers by past harvest practices.

VI. Summary. Ratings reflect the low number of known sites as well as the narrow ecological tolerance of these rare species.

VII. Mitigation. Mitigation may improve the ratings for these species.

A. Geographic Extent. Pacific Northwest wide.

B. Specific Habitats. All forested stands below 4,000 ft.

C. Mitigation Measures. Inventory for these species to identify new populations throughout

the forest and survey before permitting site-specific major actions. Protection of key sites for the species by designation of Botanical Special Interest Areas or Areas of Critical Environmental Concern are important mitigation for them. Protection buffers should be established around occurrences of these species in the managed late-successional areas and in the matrix. A study of these species' biology should be conducted to provide better direction in determining other management guidelines. A conservation strategy should be developed for these species on an interagency basis. The State Natural Heritage Programs should assist with this coordination and store the information in their database.

Old-growth stand fragments, including those 10-40 acres in size as distributed across the landscape, should be maintained as refuges for these lichen species and for their dispersal into surrounding Matrix forests when environmental conditions become suitable. Increasing the acreage of lower elevation old-growth stands in the reserve system would be beneficial for these species.

Retention trees should be the big, old trees with large lateral branches and trees that have emergent crowns. Maintaining the same leave trees over several harvest rotations is important due to the poor dispersal and slow colonization of these lichens.

Mitigation for nitrogen-fixing lichens would ideally avoid scattered retention models for two reasons. First, preliminary data shows that from 10-20% of the retained trees in a cut unit have blown down in scattered cuts. Second, field observations suggest that nitrogen-fixing are sparse in retained old growth trees whose neighbors have been removed (Neitlich 1993). Transplant studies likewise suggest that lichens transplanted from interior forest to edge environments actually lose thallus weight after one year (Sillett 1993, unpublished data). Both these data suggest that exposure of unacclimated lichens to the harsher conditions of an edge environment results in poor growth and high mortality.

Retention trees should be clumped in managed Matrix stands to moderate climatic factors and provide a variety of microhabitats which contribute to the survival of many lichen species. These old-growth clumps act as "seed trees." Maintain patches of large, old trees within the forest Matrix rather than leaving widely spaced individual retention trees would be much better for the conservation and enhancement of these species. These clumps should be a minimum of 4 acres in size. These patches may then become the source of genetic material and propagules to disperse lichens into the adjacent stands when conditions become suitable.

No herbicide use after harvesting, and limited piling and slash burning. Use natural regeneration that encourages hardwoods as well as conifer regeneration. Several studies of young managed stands have demonstrated the utility of hardwoods in increasing bird diversity. Stands scheduled to be thinned might be selectively thinned to retain and release hardwoods.

Recreational tree climbing has recently increased in popularity. Tree climbers have heavy impacts on the boles and interior crown zone which supports the richest lichen flora. Climbers often trample and remove large epiphytic moss mats and patches of near-bole rare lichens (e.g., *Nephroma occultum*). The effects of recreational climbing should be studied, and limitations should be established where needed.

Air quality monitoring should be established to determine baseline conditions as well as to monitor changes in forest health.

D. Benefits. These species produce significant amounts of nitrogen for the forest nutrient

cycling. Protection of known sites will maintain existing populations on federal lands.

I. **Species Group. Nitrogen-fixing Lichens (20 species)**

Lobaria oregana
Lobaria pulmonaria
Lobaria scrobiculata
Nephroma bellum
Nephroma helveticum
Nephroma laevigatum
Nephroma parile
Nephroma resupinatum
Pannaria leucostictoides
Pannaria mediterranea
Pannaria saubinetii
Peltigera collina
Peltigera neckeri
Peltigera pacifica
Pseudocyphellaria anomala
Pseudocyphellaria anthraxis
Pseudocyphellaria crocata
Sticta beauvoisii
Sticta fuliginosa
Sticta limbata

II. **FEMAT Rating. 17-56-23-4**

III. **Modifications due to changes in Alternative 9. None**

IV. **Explanation of Rating.**

A. **Natural History.** Twenty species are treated in this group. In conifer forests, many of these species are restricted to stands greater than 200 years old (Pike 1972, Lesica et al. 1991, Goward 1992, McCune 1993). In another study, these species were found either in 140 year old and older stands or in stands with greater than 50% of their pooled biomass from old-growth stands (Neitlich 1993). Neitlich (1993) found that these species develop the majority of their biomass in old-growth forests (over 140 years old). He found the most dramatic increase in overall forest lichen biomass overtime is primarily due to these nitrogen-fixing lichens. Estimates of the lichen biomass in old-growth stands are 4656 kg/ha and (2600 kg/ha) by Neitlich (1993) and McCune (1993) respectively. These nitrogen-fixing lichens makes up over 5% of the biomass in the canopy of mature conifer forests (Pike 1972). The known sites for most of these species are from relatively low elevations (<3000'). These species generally do not colonize a forested stand until it is over 140 years old, when the texture of the bark is suitably rough and the microclimate is ameliorated by the multilayered canopy.

Both biomass and species presence should be considered when determining the strength of the association between plant species and forest age (Neitlich 1993). In England, some of these same lichen species are used as indicators of woodland age and ecological continuity (Broad

1989, Rose and Wolseley 1984). The decline of these nitrogen-fixing lichens in England is attributed to selective cutting of the mature large diameter trees (Rose 1988).

B. Past Actions. Much of the suitable habitat has been harvested.

C. Species Range. Five of these species are endemic to the Pacific Northwest of North America and the others are known from northern Europe and the Pacific Northwest. Many of these species also occur occasionally east of the Cascade Mountains in pockets of old-growth forests influenced by maritime climatic conditions. They occur with populations of vascular plant populations that are referred to as coastal disjunct species. The pacific yew and the flowering dogwood are examples of such disjunct vascular plant species.

D. Non-habitat Factors. This group of species is very sensitive to air pollutants (Hawksworth and Hill 1984).

E. Inadequate Information. These are fairly large and distinct species that are easy to identify and their distributions are fairly well known relative to other lichen species. Additional inventory and research are needed to better direct active management.

F. Features of the Alternative. These species, like other conifer canopy epiphytes, require the retention of aggregates of standing trees to maintain suitable microclimate and provide for the dispersal of the species. Therefore, the late-successional reserves will provide habitat for this species group if the species occur within the reserves. The Riparian Reserves also provide suitable habitat for these species (Neitlich 1993).

V. Cumulative Effects Assessment. The stand dynamics and microclimate in young forested stands may not provide suitable conditions for the growth of these species. Therefore, short rotations and adaptive management that may help other old-growth associated plants or animals may not be beneficial to these species. Increased human population growth at the lower elevations as well as degraded air quality pose risks to the viability of these species.

VI. Summary. Ratings reflect the documented close association with old-growth stands and the slow colonization rates by these species.

VII. Mitigation. Mitigation will improve the ratings for these species.

A. Geographic Extent. Pacific Northwest wide.

B. Specific Habitats. All forested stands.

C. Mitigation Measures. A conservation strategy should be developed for this important functional species group on an interagency basis.

Old-growth stand fragments, including those 10-40 acres in size as distributed across the landscape, should be maintained as refuges for these lichen species and as dispersal centers for colonization of surrounding Matrix forests when environmental conditions become suitable. Increasing the acreage of lower elevation old-growth stands in the reserve system would be beneficial for these species.

Retention trees should be the large, old trees with large lateral branches and trees that have emergent crowns. Maintaining the same leave trees over several harvest rotations is important due to the poor dispersal and slow colonization of these lichens. Key retention trees should be

selected that contain large amounts of lichens and mosses.

Retention trees should be wind-firm clumped in managed Matrix stands to moderate climatic conditions and provide a variety of microhabitats which contribute to the survival of many lichen species. Clumps of retention trees should be composed of mature trees and should be a minimum of 4 acres in size to provide ameliorated conditions within the clump. These clumps need some measure of protection from edge-related mortality. Topography, natural breaks, ridges and aspects will play a role in the prescription. If high risk of mortality from wind or other sources is anticipated, the prescription should address minimizing losses from the clump by extending a feathering or partial cutting outside of the core zone. The goal is to slow or deflect wind as it hits the edge created by the harvesting. These old-growth clumps act as "seed trees". Maintaining patches of large, old trees within the forest Matrix rather than leaving widely spaced individual retention trees would be much better for the conservation and enhancement of these species. These patches may then become the source of genetic material and propagules for lichen dispersal into the adjacent stands when conditions become suitable.

Broadcast burning in retention units also appears to have an effect on retained epiphytes. Burnings should be of low enough intensity to avoid undue damage. No herbicide should be used after timber harvesting, with limited piling and slash burning.

Avoid dense stocking if plantations are used to regenerate sites. If sites are planted spacing should be established in a variable pattern to encourage stand heterogeneity. Use natural regeneration that encourages hardwoods as well as conifer regeneration. Select a diversity of tree types for green tree retention and regeneration including Pacific yew and bigleaf maple rather than maintaining the past biases for conifers.

The abundance of nitrogen-fixing lichens should be monitored in key reserve areas to determine the effects of air quality and any other habitat characteristics on these species.

Nitrogen-fixing lichens are negatively affected by air pollution and are especially sensitive to sulfur dioxide (Hawksworth and Hill 1984). Air quality in forested areas is important to maintain healthy populations of these species. Air quality monitoring should be established to determine baseline conditions as well as to monitor changes in forest health.

D. Benefits. These mitigation measures should maintain or increase the populations of these nitrogen-fixing lichens. An increase in these species will add significant amounts of nitrogen to the forests. This additional nitrogen will improve the health of these forests. These lichens are also eaten by many forest invertebrates.

I. Species Group. Pin Lichens (16 species)

Calicium abietinum
Calicium adaequatum
Calicium adpersum
Calicium glaucellum
Calicium viride
Chaenotheca brunneola

Chaenotheca chrysocephala
Chaenotheca ferruginea
Chaenotheca furfuracea
Chaenotheca subroscida
Chaenothecopsis pusilla
Cyphelium inquinans
Microcalicium arenarium
Mycocalicium subtile
Stenocybe clavata
Stenocybe major

II. FEMAT Rating. 22-46-29-3

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Sixteen species are treated in this group. These small to diminutive lichens resemble small pins arising from a bed of green algae. They are inconspicuous but are well documented as being closely associated with late-successional and old-growth forests in Europe and North America (Rose 1992, Selva 1993, Tibell 1992). These different genera are all taxonomically and ecologically related, occurring in sheltered microsites with high atmospheric humidity provided by old-growth forest conditions (Tibell 1980, & 1992). They often occur on the underside of large leaning trees. Complex canopy structure and leaning boles of trees are optimal sites for these species. They are often found on hard snags. Pin lichens are substrate and texture specific. Some species are found on rough textured Douglas-fir bark while others occur on the smoother bark of cedar or maple trees. These species are a good measure of the textural and structural diversity of a forest stand.

B. Past Actions. Much of the suitable habitat has been harvested.

C. Species Range. Only one of these species, *Stenocybe clavata*, is endemic to the Pacific Northwest of North America and the others are known from northern Europe and the Pacific Northwest.

D. Non-habitat Factors. None known.

E. Inadequate Information. These are diminutive species that are poorly known or collected in the Pacific Northwest. Positive identification of these species requires microscopic examination. Additional inventory and research are needed to better determine the distribution and ecology of these species in the Pacific Northwest.

F. Features of the Alternative. These species, like other conifer canopy epiphytes, require the retention of aggregates of standing trees to maintain suitable microclimate and provide for the dispersal of the species. Therefore, the late-successional reserves will provide habitat for this species group if the species occur within the reserves. The Riparian Reserves will benefit some of these species which are found on the hardwoods growing in the riparian zones in the Pacific Northwest.

V. Cumulative Effects Assessment. The stand dynamics and microclimate in young forested stands do not provide suitable conditions for the growth of these species. Therefore, short rotations and adaptive management that may help other old-growth associated plants or animals may not be

beneficial to these species.

VI. Summary. Ratings reflect the documented close association with old-growth stands and the textural and substrate specific habit of these species.

VII. Mitigation. Mitigation may improve the ratings for these species.

A. Geographic Extent. Pacific Northwest wide.

B. Specific Habitats. All forested stands.

C. Mitigation Measures. A conservation strategy should be developed for this species group on an interagency basis.

Old-growth stand fragments, including those 10-40 acres in size as distributed across the landscape, should be maintained as refuges for these lichen species and as dispersal centers for colonization of surrounding Matrix forests when environmental conditions become suitable.

Retention trees should be the large, old trees with large lateral branches and trees that have emergent crowns. Maintaining the same leave trees over several harvest rotations is important due to the poor dispersal and slow colonization of these lichens. Key retention trees should be selected that contain large amounts of lichens and mosses and are surrounded by other retention trees to moderate climatic conditions and protect from wind damage.

Retention trees should be clumped in managed Matrix stands to moderate climatic conditions and provide a variety of microhabitats which contribute to the survival of many lichen species. Clumps of retention trees should be composed of at least 4 acres to provide ameliorated climatic conditions within the clump. These old-growth clumps act as "seed trees". Maintaining patches of large, old trees within the forest Matrix rather than leaving widely spaced individual retention trees would be much better for the conservation and enhancement of these species. These patches may then become the source of genetic material and propagules for lichen dispersal into the adjacent stands when conditions become suitable.

Selecting the retention trees that are the largest and oldest, along with some asymmetrical trees, and leaning live and dead trees, is critical for the maintenance of these species. Leaning trees can only be retained safely by clumping the retention trees. Leaning trees and exposed but sheltered root masses are also suitable substrate for these species. "Hazard" trees are often optimal suitable substrate for these species and they should not be harvested in the late-successional reserves. Retention of large coarse woody material will benefit these species. This coarse woody material should be retained within the retention tree clumps to maintain microclimatic conditions.

No herbicides should be used after timber harvesting, with limited piling and slash burning. Avoid dense stocking if plantations are used to regenerate sites. Use natural regeneration that encourages hardwoods as well as conifer regeneration. Select a diversity of tree types for green tree retention and regeneration including Pacific yew and bigleaf maple rather than maintaining the past biases for conifers.

D. Benefits. These mitigation measures may maintain the populations of these Pin lichens and are beneficial to many other plant and animal species. These species are valuable indicators of

forest continuity.

I. Species Group. Rare Rock Lichens (2 species)

Pilophorus nigricaulis

Sticta arctica

II. FEMAT Rating. 3-13-56-29

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Two species are treated in this group. *Sticta arctica* occurs on the rocky ridgeline of Saddle Mountain in the Coast Range of Oregon. Several other more common rock lichens occur on rock outcrops within the forested matrix on the mountain tops near the coast in the Coast Range. These rock-occurring species appear to need the shade and shelter of adjacent trees to ameliorate the drying effects on sunny days. They also need the high amounts of precipitation and interception of fog that is so common in the Coast Range. The other rare species *Pilophorus nigricaulis* occurs on talus rock patches within old-growth stands with low fire frequencies. The only two known sites for this species are in the 600 year old stand in Crabtree Research Natural Area and on a forested north-facing talus slope near Multnomah Falls in the Columbia River Gorge. Other rock-occurring species could be included in this list but were not due to a lack of information on distribution or ecology. These rare rock lichen species may occur on talus slopes, monoliths (which emerge from the surrounding canopy), and rock piles which do not. These special habitats are critical to many wildlife species and bryophytes as well as lichen species.

B. Past Actions. Many of the suitable habitats for these species have been utilized as quarries for road building and the surrounding forested stands have been harvested.

C. Species Range. *Sticta arctica* is known from the Alaskan arctic and sporadically along the Alaskan coast, but only one disjunct site in the lower Pacific Northwest on State of Oregon lands at Saddle Mountain in the Coast Range of Oregon. *Pilophorus nigricaulis* is known from two sites in Oregon and three from Washington. It has been identified from basalt and andesite cliffs in the Columbia Gorge (Multnomah Falls, OR; Multnomah Co.); the Oregon Cascades (Shaffer Creek Research Natural Area, Linn Co.); Mt. St. Helens; and the Sulfur Creek Lava Flow and Austin Pass areas (Whatcom Co.) of the Mt. Baker National Forest, Washington. It has been recorded at several locations in British Columbia. This species is listed as threatened by the Oregon Natural Heritage Program.

D. Non-habitat Factors. None known.

E. Inadequate Information. The distributions of these species are poorly known. Additional inventory and research are needed to better determine the distribution and ecology of these species in the Pacific Northwest.

F. Features of the Alternative. The late-successional reserves will provide habitat for this species group if the species occur within the reserves. The Riparian Reserves do little to

benefit these species which are generally not found in the riparian zones in the Pacific Northwest.

V. **Cumulative Effects Assessment.** Road building and use of rock outcrop areas as quarries for road building or as yarding sites has potentially destroyed suitable habitat for these species. The stand dynamics and microclimate in young forested stands do not provide suitable conditions for the growth of these species. Therefore, short rotations and adaptive management that may help other old-growth associated plants or animals may not be beneficial to these species.

VI. **Summary.** Ratings reflect the low number of known sites for the species and the lack of federal management on some of those sites.

VII. **Mitigation.** Mitigation may improve the ratings for these species.

A. **Geographic Extent.** Pacific Northwest wide.

B. **Specific Habitats.** All forested stands.

C. **Mitigation Measures.** A conservation strategy should be developed for this species group on an interagency basis.

Old-growth stand fragments with rock outcrops or sheltered talus, including those 10-40 acres in size as distributed across the landscape, should be maintained as potential refuges for these rock lichen species. Rocky sites should not be used as yarding sites or roadways until they have been surveyed for potential special habitats and special status species.

Special habitats such as rock talus, monoliths, and rock piles should be surveyed for and considered in context with the surrounding forest. Consider the abundance and distribution of this type of habitat in the watershed or planning area. If these special habitats are determined critical to plants or animals in these landscape positions then they should be protected to maintain their integrity. These special habitats are considered the core area and a zone of influence should also be determined. Identify the site specific environmental factors controlling or influencing the habitat. The size, shape and management actions in the zone of influence will dictate prescription for a buffer if necessary (See Willamette NF Guide for Special Habitats). Generally buffering special habitats with a "halo" of trees at least one tree height in width maintains the appropriate shade and microclimate. Similar to clumps of retention trees, the edges may need to be feathered to prevent blowdown.

No herbicides should be used after timber harvesting, with limited piling and slash burning. Avoid dense stocking if plantations are used to regenerate sites. Use natural regeneration that encourages hardwoods as well as conifer regeneration. Select a diversity of tree types for green tree retention and regeneration, including Pacific yew and bigleaf maple, rather than maintaining the past biases for conifers.

Some of the quarries could be rehabilitated to improve the quality of the habitat for wildlife and plants. Some quarries over time will naturally rehabilitate favorably while others may need some recontouring and road closures to promote their rehabilitation.

D. **Benefits.** These mitigation measures may maintain the populations of these rare rock lichens and their habitats that are beneficial to many other plant and animal species.

I. **Species Group. Riparian Lichens (9 species)**

Cetrelia cetrarioides

Collema nigrescens

Leptogium burnetiae var. *hirsutum*

Leptogium cyanescens

Leptogium saturninum

Leptogium teretiusculum

Platismatia lacunosa

Usnea longissima

II. **FEMAT Rating. 9-54-32-5**

III. **Modifications due to changes in Alternative 9. None**

IV. **Explanation of Rating.**

A. **Natural History.** There are nine species treated in this group. They occur as epiphytes on trees within the riparian areas. These species are restricted to or are more abundant on hardwood species than softwoods. The presence of hardwoods and increased humidity within riparian areas are critical for these species. Hardwoods receive greater amounts of direct moisture in their canopies in the winter when defoliated than softwoods do. This difference in amount and the frequency of moisture as well as the different substrate, acidity, and increased lighting greatly influences these species' natural history and distribution. The larger and older trees are the best substrate for these species. One species, *Usnea longissima*, also occurs in Europe where it is well documented to have experienced marked declines and local extirpation (Olsen and Gauslaa 1991). It is associated with open water and low-lying landscape positions that are frequently foggy. They occur only at mid to low elevations. Many of these lichen species are known to be dispersal limited (Esseen et al. 1981).

B. **Past Actions.** Much of the suitable habitat has been harvested.

C. **Species Range.** These species are known from the Pacific Northwest and northern Europe.

Cetrelia cetrarioides occurs widely in British Columbia and Alaska. It has been found at nine sites in the study area. In Oregon, it has been collected in open habitats in the Dunn State Forest (Benton Co.), the Coast Range near Nashville (Lincoln Co.), and the ridgetop of Neahkahnie Mountain (Tillamook Co.) in the Coast Range. It has been found in Washington in low to mid-elevation forests at Dog Mountain (Skamania Co.) and Chinook (Pacific Co.) in the southeast to Mt. Baker and Bellingham (Whatcom Co.) in the north.

Collema nigrescens has been collected from ranges as disparate as southeast Alaska and the Galapagos Islands in Ecuador. It has been found in 11 sites in Oregon and three sites in Washington. In most occurrences within the study area, it has been found on hardwoods, most commonly *Quercus garryana*.

Leptogium cyanescens has a broad distribution, ranging from Ecuador to Alaska and including most of eastern North America. Only one record has been located from the study area. It was found growing on a shrub in the Dunn State Forest in Oregon (Benton Co.). Throughout its range it appears to grow most abundantly on hardwoods and shaded rocks.

Only five records exist for *Leptogium teretiusculum* in regional herbaria. Four of these are in British Columbia and Montana. One record exists for Oregon, at Scout Lake, east of the Cascade Crest (Jefferson Co.).

Platismatia lacunosa ranges from southcentral Alaska to central Oregon. It appears to be most common in coastal B.C. and Alaska. Twenty four occurrences have been reported in the study area, primarily from wet Douglas-fir forests and foggy coastal or valley forests.

Ramalina thrausta occurs from moist northern interior British Columbia to Idaho and Montana, but also has a small population in the study area. One specimen has been found from Mendocino County in California (near Albion); two specimens have been found from the Coast Range and coast in Oregon (Tillamook and Benton Co.'s); two specimens have been located from the North Cascades area (Whatcom Co.) in Washington.

Usnea longissima ranges from Alaska to northwest California, but appears most abundant in the northcentral portion of this range. Twenty-seven occurrences were found in the study area, mostly from low- to mid-elevation wet coniferous or mixed coniferous-hardwood forests and swamps.

D. Non-habitat Factors. This group of species is very sensitive to air pollutants (Hawksworth and Hill 1984).

E. Inadequate Information. A few of these are large and distinct species that are easy to identify and their distributions are fairly well known relative to other lichen species. Other species in this group are not as large and have not been well inventoried. Additional inventories and research are needed to better direct active management.

F. Features of the Alternative. These species, like other canopy epiphytes, require the retention of aggregates of standing trees to maintain suitable microclimate and to aid dispersal of the species. Therefore, the late-successional reserves and Riparian Reserves will provide habitat for this species group. Watershed analysis will benefit these species if they are specifically addressed in that analysis.

V. Cumulative Effects Assessment. The stand dynamics and microclimate in young forested stands may not provide suitable conditions for the growth of these species. Therefore, short rotations and adaptive management that may help other old-growth associated plants or animals may not be beneficial to these species. Moss collecting often destroys these lichen species as well. Increased human population growth at the lower elevations as well as degraded air quality pose risks to the viability of these species.

VI. Summary. Ratings reflect the documented association with mature riparian vegetation and the fact that the Riparian Reserves were narrower for this alternative than for the other alternatives. Documented declines by some of these species in Europe also influenced the low ratings for this species group.

VII. Mitigation. Mitigation will improve the ratings for these species.

A. Geographic Extent. Pacific Northwest wide.

B. Specific Habitats. All forested stands.

C. Mitigation Measures. A conservation strategy should be developed for this important

functional species group on an interagency basis.

These species should be inventoried for when conducting watershed analysis and sites located should be protected and buffered as needed.

No herbicide should be used after timber harvesting, with limited piling and slash burning. Avoid dense stocking if plantations are used to regenerate sites. If sites are planted spacing should be established in a variable pattern to encourage stand heterogeneity. Use natural regeneration that encourages hardwoods as well as conifer regeneration. Select a diversity of tree types for green tree retention and regeneration including Pacific yew, alder, ash, and bigleaf maple rather than maintaining the past bias for conifers.

Moss and lichen harvesting has become a significant industry in the Pacific Northwest and may represent a serious threat to epiphytes, especially in coastal and riparian areas. It needs to be monitored and controlled to preserve these riparian lichen species. Studies should address the effect of moss harvesting on riparian and nitrogen-fixing lichen species before continuing to allow commercial harvesting.

Riparian lichens are negatively affected by air pollution and are especially sensitive to sulfur dioxide (Hawksworth and Hill 1984). Air quality in forested areas is important to maintain healthy populations of these species. Air quality monitoring should be established to determine baseline conditions as well as to monitor changes in forest health.

D. Benefits. These mitigation measures should maintain or increase the populations of these riparian lichens. An increase in these species will buffer the extremes in runoff and nutrient flux in the forest canopy and in the streams. This will buffer the sediment flush, thereby improving water quality.

I. Species Group. Aquatic Lichens (3 species)

Dermatocarpon luridum

Hydrothyria venosa

Leptogium rivale

II. FEMAT Rating. 10-47-27-16

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. There are three species treated in this group. They are truly aquatic and unlike most other lichens will die if desiccated (Dennis et al. 1984). They are found on rocks in streams where they provide habitat for aquatic invertebrate populations. These aquatic lichens are good indicators of water quality and constancy of stream flow levels. *Dermatocarpon luridum* is more tolerant than the others to periods of desiccation. It is found in higher order streams that experience greater stream flow fluctuations and flooding. Streams where these species occur are at low to mid elevations.

B. Past Actions. Much of the suitable habitat has experienced habitat siltation and other

disturbances.

C. Species Range. *Hydrothyria venosa* is endemic to North America with populations in the Pacific Northwest and the Appalachian Mountains. Most of the populations in the Appalachian Mountains have been extirpated. In the Pacific Northwest, *Hydrothyria venosa* ranges from montane central California (Madera Co., Sierra National Forest) to central British Columbia. Four sites are known from the Sierra Mountains in California (Yosemite National Park, Big Trees State Park, Sierra National Forest, and Mariposa County). Fourteen sites are known from the Cascades in Oregon and seven in Washington. Known Oregon locations include the Willamette National Forest, Mt. Hood National Forest, Deschutes National Forest, Three Sisters Wilderness and Crater Lake National Park. Known Washington locations include Mt. Rainier, Mt. Baker National Forest, and Olympic National Park. Most records come from clear, cold streams with stony bottoms from old-growth or pristine forests at mid- to high-elevations (650-2100m; 1800-6500 ft).

Leptogium rivale is known from two mid-order streams in the H.J. Andrews and one stream in the Bitterroot Mountains of Montana.

Dermatocarpon luridum has been found discontinuously in northern and southern British Columbia, Oregon, Colorado, Virginia and northern Europe. In the study area, it is known only from Silver Creek Canyon in Silver Falls State Park, Oregon (Marion Co.)

D. Non-habitat Factors. Acid rain may have an impact on these species. This group of species is very sensitive to siltation and fluctuation of water flows.

E. Inadequate Information. Species distributions are poorly known. Additional inventories and research are needed to determine the distribution of these species.

F. Features of the Alternative. The amount of late-successional reserves and Riparian Reserves will provide habitat for this species group. Watershed analysis will benefit these species if they are specifically addressed in that analysis. Watershed protection guidelines are beneficial to these species. Larger Riparian Reserves would afford more protection to these species.

V. Cumulative Effects Assessment. Cumulative effects of stream disturbances from logging and road building upstream may have a detrimental impact on these species.

VI. Summary. Ratings reflect the restriction of these species to extremely clear free-flowing streams. The limited dispersal ability of these species and their rarity affect their rating. Documented declines by *Hydrothyria venosa* in the Appalachian Mountains also influenced the low ratings for this species group.

VII. Mitigation. Mitigation will improve the ratings for these species.

A. Geographic Extent. Pacific Northwest wide.

B. Specific Habitats. Stream corridors.

C. Mitigation Measures. A conservation strategy should be developed for this species group on an interagency basis.

These species should be inventoried for when conducting watershed analysis and known sites should be protected and buffered as needed. The percentage of the watershed that is

harvested should be evaluated due to the sensitivity of these species to siltation.

No herbicide should be used after timber harvesting, with limited piling and slash burning. These aquatic lichens are negatively affected by any type of water pollution. Water quality in forested streams is important to maintain healthy populations of these species. *Hydrothria venosa* appears to be more sensitive to stream sediment than are salmon.

Reintroduction might be attempted in restored stream courses by transplantation of rocks with viable *Hydrothyria venosa*.

D. Benefits. These mitigation measures should maintain the populations of these aquatic lichens. Maintaining these species will benefit stream water quality (via nutrient removal), invertebrate species as well as fish and wildlife that live in these streams. These aquatic lichens are valuable indicators of water quality.

I. Species Group. Rare Oceanic Influenced Lichens (12 species)

Bryoria pseudocapillaris
Bryoria spiralifera
Bryoria subcana
Buellia oidalea
Erioderma solediatum
Hypogymnia oceanica
Leioderma solediatum
Leptogium brebissonii
Niebla cephalota
Pseudocyphellaria mougeotiana
Teloschistes flavicans
Usnea hesperina

II. FEMAT Rating. 0-12-59-29

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Twelve species are treated in this group. Generally there are few to only one known location for these species. They are all epiphytes that occur within sight of the ocean. Many of them are extreme disjunct populations, with affinities to the subtropical or pantropical floras. Many of these species only occur on peninsulas and headlands. Frequent fog along the coast, combined with moderate temperatures, create a unique environment for these lichens.

Bryoria pseudocapillaris is found in exposed sites growing on stunted Sitka spruce and ericaceous shrubs. Sitka spruce forests intermingled with open sand dunes directly along the coast are the typical site for this species. *Erioderma solediatum*, *Leioderma solediatum*, and *Leptogium brebissonii* occur on old ericaceous shrubs in broken Sitka spruce and lodgepole pine forests on stabilized dunes at Sutton Creek Recreation Area. *Niebla cephalota* occurs on both Sitka spruce and rock along the windswept coast on promontories of land.

Pseudocypbellaria mougeotiana is known from one site in the Pacific Northwest on old-growth Sitka spruce on the immediate coast. *Usnea hesperina* is also known only from one site in the Pacific Northwest. It occurs in a broken dune forest of old lodgepole pines at Sutton Creek Recreation Area.

B. Past Actions. Most of the suitable habitat is private lands and has been modified due to its high scenic and recreational values and due to the coastal highway.

C. Species Range. Immediate coast throughout the study area. *Bryoria pseudocapillaris* is known from two sites in the study area: Cape Blanco and Sutton Creek Recreation Area, both on the Oregon coast.

Bryoria spiralifera is known from only from the Samoa Peninsula in Humboldt County, California where it is scattered, but not uncommon (Brodo and Hawksworth 1977; Neitlich et al. 1993).

Bryoria subcana is epiphytic on *Picea* along coastal bays and streams in a few sites in Alaska and B.C., and found on conifers, lignum and sand hills in one site in Oregon (Clatsop Co.) and two in California off Monterey Bay (Brodo and Hawksworth 1977).

Buellia oidalea ranges from Baja, Mexico to Vancouver Island, British Columbia. In the study area it is known only from three sites in Washington. These are Narbeck Creek in Everett (Snohomish Co.), Bellingham (Whatcom Co.) and the Lathrop Forest (Pierce Co.).

Erioderma sorediatum is known from three sites in the study area: Sutton Creek Recreation Area, dunes near Florence, Oregon (Lane Co.), Eel Creek Recreation Area, and Cape Arago State Park (Coos Co.).

Hypogymnia oceanica has been found widely from southeast Alaska and coastal British Columbia. It has been collected from one site in the study area: the H. J. Andrews Experimental Forest, Willamette National Forest, Oregon (Lane Co.) It is presumed that the maritime microclimates in the old growth in which it occurs here mimics those in its primarily coastal distribution.

Leioderma sorediatum has been located Twice in the study area, at the Sutton Creek Recreation Area in Oregon (Lane Co.) and Eel Creek Recreation Area (Coos Co.).

Leptogium brebissonii is known from only one location in the study area, Neahkahnie Mountain in Oregon (Tillamook Co.).

Niebla cephalota has been documented from San Luis Obispo, California to maritime northern Washington. Six sites have been documented in the study area. In Oregon, this species is known from Cape Arago (Coos Co.), Cape Blanco (Curry Co.) and Sutton Creek Recreation Area (Lane Co.). In Washington, it is known from San Juan Island (San Juan Co.), Fidalgo Island (Skagit Co.) and Deception Pass on Whidby Island (Island Co.).

Pseudocypbellaria mougeotiana is a southern hemisphere species known from two sites in the study area. It has been documented at the mouth of Gwynn Creek (Lincoln Co.) and at Cascadia State Park (Linn Co.).

Teloschistes flavicans occurs discontinuously from Ecuador to Oregon. It has been documented at two sites in the study area, both in Oregon. Known locations are the forested

headland at Cape Lookout and Sand Lake both in Tillamook County. Five sites are known from central California, San Mateo, Monterey and Santa Cruz Island Counties.

Usnea hesperina is known only from Sutton Creek Recreation area (Lane Co.).

D. **Non-habitat Factors.** These species are sensitive to air pollutants.

E. **Inadequate Information.** Species distributions are poorly known.

F. **Features of the Alternative.** These species, like other canopy epiphytes, require the retention of groups of standing trees to maintain suitable microclimate and to aid dispersal of the species. Therefore, late-successional reserves along the coast would provide habitat for this species group but there are few reserves near the coast. The Riparian Reserves do not provide suitable habitat for this species group. Some of the areas protected for marbled murrelets may be beneficial for this lichen species group.

V. **Cumulative Effects Assessment.** Due to the accessibility, scenic values and recreational uses along the immediate coast the forests are replaced by buildings, roads, and trails. Recreational developments in the National Recreation Areas on federal lands inadvertently destroy much of the potential habitat of these species.

VI. **Summary.** Ratings reflect the limited potential for federal management along the immediate coast and the few known sites for these species. The low ratings also reflect their uncertain future, as they may even be destroyed on federal lands in an effort to develop recreational areas.

VII. **Mitigation.** Mitigation could improve the ratings for these species.

A. **Geographic Extent.** Immediate coast in the Pacific Northwest.

B. **Specific Habitats.** Immediate coast within 1-2 miles of the ocean on trees or shrubs. Sitka spruce, lodgepole pine and ericaceous shrubs support these oceanic influenced lichen species.

C. **Mitigation Measures.** Inventory for these species to identify new populations. Protection of key sites for the species by designation of Botanical Special Interest Areas or Areas of Critical Environmental Concern are important mitigation for these species. Protection buffers should be established around occurrences of these species in the National Recreation Areas, in managed late-successional forests and in the Matrix. A study of these species' biology should be conducted to provide better direction in determining management guidelines. A conservation strategy should be developed for these species on an interagency basis.

The State Natural Heritage Programs should assist with this coordination and store the information in their database.

Known sites need to be monitored to maintain viable populations of these rare species. Sutton Creek on the Siuslaw National Forest is an important area for these species and should be given special management as a Botanical Special Interest Area. Eel Creek on the Siuslaw National Forest is also an important area for these species and should be given special management as a Research Natural Area or Botanical Special Interest Area. Recreational activities and management guidelines to conserve these unique botanical resources should be developed. Recreational facilities along the coast should minimize degradation of botanical resources. Off-highway vehicles (OHVs) that disperse exotic vascular plant species should be limited from some areas, including winter travel. Driftwood, which supports other oceanic

influenced lichen species not listed here, should be protected from collection and burning.

Coordination between state and private sectors to inventory, evaluate and establish sites for conservation of these species is necessary. Acquisition of sites along the coast containing any key sites for these species should be pursued. This group of lichens rated lower than any other functional species group.

D. Benefits. Protection of known sites will preserve this element of biodiversity on the coast. The rarity of this lichen species group indicates the rarity of the coastal habitats as a whole and the conservation of these species may contribute to conservation of other plant or animals. It would also permit the further study of the species and maintain existing populations on federal lands.

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- I. **Species.** Subalpine fir (*Abies lasiocarpa*) (Hook.) Nutt. (California only)
- II. **FEMAT Rating.** 50-13-38-0
- III. **Modifications due to changes in Alternative 9.** Changes are unlikely to affect this species.
- IV. **Explanation of Rating.**

A. Natural History. Like most conifers, *Abies lasiocarpa* is wind pollinated. Plants at high elevations are often reduced to a low bush growth habit, with spreading, prostrate stems. A good morphological description is provided in Liu (1971).

B. Past Actions. Past land managements actions are not known to have affected this species within California.

C. Species Range. *Abies lasiocarpa* is the most widely distributed fir next to *A. balsamea* in North America. Its range extends along the Pacific Coast from the north end of southeastern Alaska and central Yukon Territory, south to the San Francisco Mountains of northern Arizona and the Mogollon Mountains of western New Mexico (Liu 1971). Elevational range in Oregon and Washington is between 600 and 2400m (Liu 1971). This species was not known to occur in California until 1969 (Sawyer et al. 1970). Only two populations are currently known from California; both occur within wilderness areas. The habitat of *Abies lasiocarpa* in these areas is montane valley bottoms and moist sheltered slopes, characteristic of Salmon-Scott enriched conifer forest type (J. Nelson, pers. comm., Keeler-Wolf 1990). At both sites it grows with *Picea engelmannii*.

D. Non-habitat Factors. Global warming is the only foreseeable threat to this species.

E. Features of the Alternative. Ratings for *Abies lasiocarpa* were identical for all options; features of the alternative were irrelevant.

- V. **Cumulative Effects Assessment.** No populations are known from private or state lands.
- VI. **Summary.** No mitigation could be identified to elevate the ratings.
- VII. **Mitigation.** None identified.

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Keeler-Wolf, T. 1990. Ecological surveys of Forest Service Research Natural Areas in California (p. 46 Sugar Creek Research Natural Area). Pacific Southwest Research Station, USDA Forest Service Gen. Technical Report PSW-125.

Knowledgeable Individuals:

Sawyer, John, Humboldt State University, Arcata, California.

Julie Nelson, Shasta Trinity National Forest, Redding, California.

I. Species. Sugar stick (*Allotropa virgata*) Torrey & Gray

II. FEMAT Rating. 28-53-16-4

III. Modifications due to changes in Alternative 9. Long rotations and large woody debris were identified as factors important to the viability of *Allotropa virgata* by the panel members. Reduction of the originally proposed 180 year rotation in California could lower ratings for this species, which is apparently very rare in this portion of its range. Panel members indicated that this dry site species occurs on sites associated with past fires. Prescribed fire standards and guidelines may increase viability.

IV. Explanation of Rating.

A. Natural History. *Allotropa virgata* occurs in closed canopy pole, mature, and old-growth seral stages in *Pseudotsuga menziesii*, *Tsuga heterophylla*, *Abies grandis*, *Abies amabilis*, and *Pinus contorta* vegetation series, ranging from 1500 to 5000' elevation within the range of the northern spotted owl (Ecology databases, 11/92). Wallace (1974) reports this species is typically found at higher elevations in the inland portions of its range, occurring from 250 to 10,000'. It is not restricted to old-growth, but the largest populations occur there (Luoma, pers. comm. 4/20/93). It has been observed in 60 year old stands and those with 11" diameter trees, but does not appear to tolerate competition. It is never abundant and may not flower often. Populations are highly isolated. It occupies dry, well-drained soils, with abundant coarse woody debris (especially decay classes 4 and 5, Luoma, pers. comm. 4/20/93). Steele and Stickney (1974) also note that it appears substrate specific to decaying wood, with individuals at an Idaho site restricted to the buried margin of a partially decomposed log.

Like many members of the heath family, this species appears to be pollinated by bumblebees and may be autogamous (Wallace, 1974). Dissemination is an important consideration for this species due to its minute seeds, which have little energy reserves. In addition, it is a non-green mycotrophic species, requiring an association

with a fungus and vascular plant for establishment and survival. Due to small, ephemeral seeds and its obligate mycorrhizal relationship, large and relatively unfragmented habitat areas may be important to maintain viability and promote gene exchange. One of the mycobionts may be the commercially harvested matsutake, *Tricholoma magnivelare* (Luoma, pers. comm., 1/4/94).

Allotropa virgata may not flower every year and as documented for several close relatives, it may not emerge above ground every year (Luoma, pers. comm.). Some individuals of achlorophyllous ericads may be dormant for as many as eight years between flowering episodes (Kaye, et al. 1991). However, the above-ground stems of *Allotropa virgata* are persistent, increasing effectiveness of surveys. During its growing season, the plant is unmistakable and conspicuous, with pink and white striped stems up to over a meter in height.

Because this species is not tracked by the Heritage Programs and does not have agency status, site specific data was not available for this analysis. The Forest Service Area ecology program plot data for this species provides a useful baseline.

B. Past Actions. Fire suppression, fragmentation of habitat, and reduction in coarse woody debris are primary factors contributing to the decline of this species.

C. Species Range. In deep humus of coniferous forests at lower elevations, east slope of Cascades to near the coast, from British Columbia to California (Hitchcock and Cronquist 1973). Widespread, but rare throughout range. Noteworthy disjunctions occur in Idaho and Montana (Steele, 1974); one site described was a 250-300 year old stand of *Abies grandis* and *Thuja plicata*. This species is rarely observed in California within the range of the northern spotted owl (SAT panel notes, 11/92). See Wallace's taxonomic treatment (1975, page 17) for range map.

D. Non-habitat Factors. None noted

E. Features of the Alternative. The outcome ratings for alternative 9 were considerably lower than for alternative 1, due primarily to the inclusion of the LSOG3 fragments and the greater overall acreage of reserves in the later. Small late-successional and old-growth fragments were considered to contribute significantly to the predicted viability of the species, due to the limited dispersal capability of this species and the fragments' function as corridors. Smaller fragments are also presumed important to the mycorrhizal fungi which are symbiotic with *Allotropa virgata*. In only three options, including option 9, was there considered any projected likelihood of extirpation.

Another key factor in lower ratings for alternative 9 was the concern that riparian protection afforded by buffers and key watersheds may increase pressure to log upland sites, placing rare dry site species at greater risk.

Like many relatives with similar, complex life cycles, *Allotropa virgata* is slow to establish and may require coarse woody debris during some or all of its life cycle. Limiting mechanical disturbance within its habitat was considered important; repeated

thinnings and shorter rotations would be detrimental.

V. Cumulative Effects Assessment. Land management on state and private lands is an important consideration in maintaining the viability of this species. Due to the limited dispersal potential, corridors are critical to maintaining gene exchange. Although reported from a range of vegetation series and elevations, Hitchcock and Cronquist (1973) cite this species as occurring in low elevations. Because much of the low elevation habitat is under state and private ownership, cumulative effects of harvest on this species are a concern. Because this species does not have federal, agency, or state status, the percent of known species locations on non-federal land is unknown.

Protecting federal populations and maintaining gene-flow corridor integrity are both important to maintaining well-distributed populations throughout the range of this species.

VI. Summary. The cumulative effects assessment suggests that this species may be restricted in large part to federal lands in the future. This would result in large gaps in its historic range, particularly in the northern California, northern Oregon and southwestern Washington Coast range provinces. The effect of fragmentation of habitat on this species is unknown.

VII. Mitigation. Because *Allotropa virgata* is wide ranging and little site-specific data is available, it is difficult to evaluate how effectively alternative 9 protects known populations. Unlike many other rare plants with narrow geographic ranges, it is impractical to attempt to establish specific reserves to protect this species at this time. Because this species is occasionally found in stands as young as 60 years, it is desirable to determine which stand characteristics are conducive to its establishment. The mitigation described below would likely reduce the probability of extirpation on federal lands. In particular, survey protocols should be developed to supply baseline data and a conservation strategy providing management recommendations including prescribed fire should be prepared and implemented.

A. Geographic Extent. This species is rare throughout its range; area of greatest concern include the coast ranges, especially in California.

B. Specific Habitat. *Allotropa virgata* occurs on dry sites in most of range of the northern spotted owl, although it occupies somewhat moister sites in California.

C. Mitigation Measures.

- Develop map of extant populations and revisit historic sites (based on Herbarium records, cf. Wallace 1975) to assess general trends
- Analyze existing ecoplot data to aid in defining high probability habitat, including, if possible, analysis of abiotic factors, including precipitation, elevation, snowpack, canopy closure, as available, to formulate hypotheses for testing environmental parameters limiting distribution
- During Watershed Analysis, conduct surveys in high probability habitat, including *Allotropa virgata* as a "Species of Concern" within Vegetation Module
- Randomly select subset of known locations and revisit sites. Document

presence/absence, assess population size (map/count individuals), and collect data on fire history, coarse woody debris, and canopy closure, cover, plant association, and abiotic factors (e.g. soil moisture, seasonal precipitation, snowpack).

- Conduct surveys within sites planned for prescribed burning and establish monitoring sites to evaluate effect of fire on establishment and survival.
- Prepare Conservation Strategy incorporating preliminary information and monitoring plans, and fire prescriptions. This Conservation Strategy would most appropriately address management of all mycotrophic ericads, since requirements are likely to be similar.
- Because this species requires decaying logs, salvage of down logs should be restricted in high probability habitat.

D. Benefits. Many mycorrhizal members of the heath and orchid families inhabit Pacific northwest coniferous forests. Their life histories are among the most complex, symbiotic with other vascular plants and fungi, and typically involving mammalian seed dispersers and solitary bees for pollination. Measures which ensure protection of these complex relationships are important to maintaining the stability, integrity, and balance of the late-successional forest ecosystem. Other mycotrophic species (e.g. *Pleuricospora fimbriolata*, *Hemitomes congestum*, *Pityopsis californica*, *Hypopitys monotropa*) are often found in close association (Kaye et al. 1991) and would benefit from these mitigation measures.

References:

- Castellano, M.A. and J.M. Trappe. 1985. Mycorrhizal associations of five species of Monotropoideae in Oregon. *Mycologia* 77:499-502.
- Furman, T.E. and J.M. Trappe. 1971. Phylogeny and ecology of mycotrophic achlorophyllous angiosperms. *The Quarterly Review of Biology* 46:219-225.
- Kaye, T., N. Fredricks, and J. Gamon. 1991. Population monitoring for fringed-pinesap on the Gifford Pinchot National Forest. Unpublished report, USDA Forest Service, Gifford Pinchot National Forest.
- Luoma, D. 1987. Synecology of the Monotropoideae within Limpy Rock Research Natural Area, Umpqua National Forest, Oregon. Unpublished M.S. thesis, Oregon State University, Corvallis.
- Steele, R. and P.F. Stickney. 1974. *Allotropa virgata* (Ericaceae), first records for Idaho and Montana. *Madrono* 22:277.
- Wallace, G.D. 1975. Studies of the Monotropoideae (Ericaceae): Taxonomy and Distribution. *The Wasmann J. Biol.* 33:88.

Knowledgeable Individuals:

Dan Luoma, Forest Sciences Laboratory, Corvallis, Oregon.
Tom Kaye, Plant Conservation Biology Program, Oregon Department of Agriculture, Salem,

Oregon.
John Gamon, Washington Natural Heritage Program, Olympia, Washington.

I. Species. Dwarf mistletoe *Arceuthobium tsugense* (Rosendahl) G.N. Jones

II. FEMAT Rating. 0-50-50-0

These ratings were based primarily on the northern portion of its range, where habitat was considered most abundant, since data on other areas was limited during the panel.

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. This member of the mistletoe family (LORANTHACEAE) occurs primarily on western hemlock, in old to very old old-growth forests, most commonly in stands greater than 600 years (Henderson, pers. comm.). According to the recent taxonomic treatment by Hawksworth et al. (1992) and work cited therein, this species is comprised of at least three segregates with distinct host ranges, shoot sizes, and marked isozyme differences. A recently described subspecies, (subsp. *mertensianae*) grows on mountain hemlock, while the subspecies *tsugense* occurs typically on western hemlock and shore pine. Factors which may influence establishment include the bark surface texture and chemistry. All dwarf mistletoes are dioecious; some wind pollination may occur at very close distances, but insect pollination may be the norm (Hawksworth and Wiens 1972). Thrips may pollinate other species of mistletoe, but other insects may be more important in pollination (Stevens and Hawksworth 1970). Birds may be involved in long-distance dispersal of seeds; seeds are viscous-coated and adhere to objects they strike (Hawksworth and Wiens 1972); flying squirrels and other arboreal mammals may also aid in dissemination. Seed dispersal occurs in late September to early November for subspecies *tsugense*; several weeks earlier than subspecies *mertensianae*. Squirrels, porcupines, birds, and other animals eat dwarf mistletoe shoots, but their effects seem to be minor (Hawksworth and Wiens 1972).

This species is important to marbled murrelets, spotted owls, squirrels and other wildlife species which nest in mistletoe inhabited trees. The mistletoe results in densely branched "witches brooms" and platforms which add structural diversity to the canopy.

Dwarf mistletoe infection reduces the tree's growth rate in both height and diameter, but there is no significant reduction until the upper half of the tree's crown is parasitized (Hawksworth and Wiens 1972).

South of Mt. Rainier, there is little forest greater than 700 years, Bull Run watershed (Mt. Hood National Forest) is among the only place in Oregon where forests this age

occur. Data on the abundance and distribution of this species on the Mt. Hood N.F. and elsewhere was not available during the panel meetings. Not all Area Ecology Programs collect data on arboreal mistletoes; data on *Arceuthobium tsugense* has not been collected in Area 7 (Mt. Hood and Gifford Pinchot National Forests), but data may be available in managed stand and Pacific yew databases (Shlisky, pers. comm.).

B. Past Actions. Harvest of many of the forests over 700 years has considerably reduced habitat for this species.

C. Species Range. The western hemlock race of *A. tsugense* subsp. *tsugense* is distributed from Alaska south to California, from sea level to about 1200 m in southern Oregon (Hawksworth et al. 1992).

D. Non-habitat Factors. Dwarf mistletoes are not among those Forest Products seasonally collected.

E. Features of the Alternative. None of the alternatives were considered to have any likelihood of having this species well distributed throughout its range; however, in options 1, 2, and 3, there was 80 percent likelihood of the species being only locally restricted, due to the protection of the late-successional and old-growth fragments.

VI. Cumulative Effects Assessment. Because little private and state land has timber within the suitable size and age class range most commonly inhabited by this species, cumulative effects were not considered important to this analysis.

VI. Summary. The association of *Arceuthobium tsugense* with old to very old stands, and the limited amount of this most suitable habitat contributed to the ratings. Late-successional and old-growth fragments were considered very important to this species. Greatest concern was expressed for this species in the northern portion of its range; however, the extent of its distribution elsewhere is unknown. Queries of the ecology databases, and additional consultation with experts on this species will be necessary to evaluate the geographical extent, appropriateness, and expected effectiveness of mitigation measures.

VII. Mitigation. Specifically protecting all stands greater than 600 years which are occupied by western hemlock and *Arceuthobium tsugense* would provide protection for this species. It may be possible to selectively infect stands to reintroduce this species, although the feasibility and effectiveness of this approach is unknown.

A. Geographic Extent. This species is rare throughout its range.

B. Specific Habitat. *Arceuthobium tsugense* is an arboreal species, parasitic on western hemlock.

C. Mitigation Measures.

- Develop map of extant populations and revisit historic sites (based on Herbarium records, cf. Hawksworth et al. 1992) to assess general trends

- During Watershed Analysis, conduct surveys in high probability habitat, including *Arceuthobium tsugense* as a "Species of Concern" within Vegetation Module
- Analyze existing ecoplot data throughout range to clarify degree of association with late-successional stands throughout range
- Coordinate with biologists conducting marbled murrelet surveys to clarify relationships between marbled murrelet nesting and *Arceuthobium* colonization of canopies.
- Protect all stands occupied by western hemlock which are greater than 600 years

Research needs:

- Inoculation of carefully selected stands to increase structural diversity and populations of *Arceuthobium tsugense* may be explored. Appropriateness of inoculating selected stands with seeds of *Arceuthobium tsugense* should first be evaluated. If reintroduction is deemed appropriate, investigate literature and if necessary, conduct tests to determine germination and establishment requirements

D. Benefits. Maps illustrating known populations within reserves and matrix will increase our ability to manage for this species. Effectiveness of inoculation of stands is unknown, but studies investigating germination and establishment requirements could increase success in introduction, if this was recommended. Incidental benefits of mitigation would include increased nesting habitat for marbled murrelets, spotted owls, flying squirrels, and other arboreal mammals.

References:

- Hawksworth, F.G., D. Wiens, and D.L. Nickrent. 1992. New western North American taxa of *Arceuthobium* (Viscaceae). *Novon* 2:204-211.
- Hawksworth, F.G. and D. Wiens. 1972. Biology and classification of dwarf mistletoes (*Arceuthobium*). USDA Forest Service. Agriculture Handbook No. 401. Washington, D.C., (map p. 155, illustration p. 154).

Knowledgeable Individuals:

- Rick Brown, National Wildlife Federation, Portland, Oregon. (Masters thesis on *Arceuthobium*)
 Jan Henderson, Mt. Baker Snoqualmie NF, Mountlake Terrace, Washington.
 Delbert Wiens Department of Biology, University of Utah, Salt Lake City, Utah.

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- I. Species. Wayside aster (*Aster vialis*) Bradshaw
- II. FEMAT Rating. 0-48-52-0

III. **Modifications due to changes in Alternative 9.** Clarification on fire standards and guidelines may increase ratings.

IV. **Explanation of Rating.**

A. **Natural History:** *Aster vialis* inhabits mid-successional (80-200 year old) conifer forest stands at low elevations. It seems to thrive most vigorously in open gaps within old-growth or edge habitat, perhaps due to lack of competition. This species may tolerate or persist after, or even benefit by some types of disturbance (e.g. prescribed fire). It does not appear to tolerate much competition, especially from weedy invaders of disturbed forests. Decreases in light, due to competing vegetation, is probably a critical element in population decline and loss of vigor (Wogen, pers. comm. 1/3/93). Seed production is highest with cross pollination between populations. Germination is very low (about 15% at best, Guerrant, 1991).

Populations are small at all sites; most have less than 100 individuals, larger populations are on private land.

B. **Past Actions.** Fire suppression, fragmentation of habitat have adversely affected this species.

C. **Species Range.** *Aster vialis* is a rare, locally endemic taxon known only from Lane, Linn, and Douglas Counties, in Oregon. It is extinct at various historically known sites. It occurs primarily along ridges between Eugene and Roseburg with higher fire frequency in partial shade in areas with the least amount of disturbance (Kagan, pers. comm.). Only one small population on private land is currently known from Linn County. Approximately twenty populations have been documented, with six new populations recorded in 1993 (Kagan, pers. comm.).

D. **Non-habitat Factors.** Low germination rate may be limiting to this species.

E. **Features of the Alternative.** Panel members felt that this species was not adequately protected in any of the options and specific standards and guidelines which addressed fire management were essential. Most of the populations fall within Zone 2 for marbled murrelets. Overall amount and distribution of forests in the matrix and spacing of the reserves were the primary influencing factors for the ratings.

VI. **Cumulative Effects Assessment.** This species is at greater risk due to fragmentation of habitat resulting from loss of populations on private land. The largest populations occur on private land; these may be key to long-term viability on federal land.

VI. **Summary.** The ratings for *Aster vialis* reflect concern that a threshold may have passed due to highly fragmented populations, fire suppression, plantation forestry, beyond which long-term population viability is uncertain. The range is so fragmented that population interactions on wide scale probably won't occur (Vascular Plant Panel Notes, 6/93). This species requires natural, "delicate" disturbance, with the role of fire probably important to maintaining viability. Restrictive guidelines which limit use of fire and tools

which mimic natural disturbance may be detrimental.

VII. Mitigation. Although considerable information has been compiled on this species, currently no species management guide or conservation strategy exists. Development of a Conservation Strategy (now scheduled by Eugene District BLM for 1995) which provides specific management direction and implementation of the mitigation measures below would improve the ratings. However, due to the past actions and cumulative effects, some risk that the species will be restricted to refugia would remain.

Important mitigation measures for this species include inventory and protection of known sites, prescribed burning on experimental basis, and density management to maintain prefire suppression community. Trend studies to determine if known populations are stable and investigations of response to selective logging and prescribed fire will be key to managing for this species.

A. Geographic Extent. Willamette Valley Province. Documented from Roseburg and Eugene Districts, BLM.

B. Specific Habitats. Low elevation forest.

C. Mitigation Measures.

- Maintain existing sites for *Aster vialis* within federal lands.
- Maintain existing forest buffers established for individual populations, and develop additional buffers where sites are adjacent to or in clearcuts.
- Maintain existing gate closures.
- Acquire privately owned *Aster* sites for Federal protection. Where acquisitions are not possible, develop cooperative agreements and conservation easements to protect *Aster* sites.
- Implement a brush control program on roadside populations that are rapidly undergoing brush invasion. Coordinate with the U.S. Fish and Wildlife Service in program implementation.
- Work with adjacent landowners, right-of-way recipients, etc. in regulating activities adjacent to the *Aster* locations that could have negative impacts on the population (e.g. roadside spraying).
- Work cooperatively with research institutions and other public and private agencies in securing funding or volunteer services for various research projects necessary in attaining information for management of *Aster vialis*.
- Avoid herbicide spraying in vicinity of all populations.
- Continue systematic inventory in conjunction with Watershed Analyses to locate additional populations.
- Develop a Habitat Management Plan/Conservation Strategy (including a Weed Management Plan) that identifies actions necessary for protection and habitat enhancement needed for maintaining minimum viable population levels, including ungulate control, insect predation, site manipulation, and experimental procedures such as prescribed understory burning.
- Collect seed for cryogenic storage and deposit at Berry Botanic Garden, Portland. In the event that populations are lost, this measure could provide genetic material to

potentially reestablish populations.

D. Benefits. Surveys are reasonably effective in locating this species. Implementation of mitigation measures could significantly decrease likelihood of species being restricted to refugia, but the effect of past actions (fragmentation and fire suppression) on potential gene exchange and genetic diversity is unknown. Effectiveness will also depend on acquisition/conservation easements on nonfederal land. Prescribed fire may be an effective tool only if we have public support in sensitive smoke management zones.

References:

Alverson, E.R. and K. Kuykendall. 1989. Field studies on *Aster vialis*. Unpublished report prepared under contract with the Oregon Department of Agriculture for the Bureau of Land Management.

Guerrant, E.O. 1991. Effects of heat on germination of *Aster vialis* seeds. Report prepared under challenge cost-share program for Eugene District BLM.

Kaye, T., K. Kuykendall, and W. Messinger. 1991. *Aster vialis*: inventory, monitoring, and pollination biology. Report prepared under challenge cost-share program for the Eugene District BLM.

Kuykendall, K. 1991. Pollination study of *Aster vialis*. Portland State University Honor's Program Senior thesis.

Knowledgeable Individuals:

Nancy Wogen, Eugene District, BLM, Eugene, Oregon.

Keli Kuykendall, Oregon State University, Corvallis.

Ed Alverson, The Nature Conservancy, Eugene, Oregon.

Ed Guerrant, Berry Botanical Garden, Portland, Oregon.

Tom Kaye, Plant Conservation Biology Program, Oregon Department of Agriculture, Salem

Russ Holmes, Roseburg District BLM, Roseburg, Oregon.

I. Species. *Bensoniella (Bensoniella oregona)*

II. FEMAT Rating. (California only) 0-0-50-50

III. Modification due to changes in Alternative 9. Shortening of rotation length in California could reduce ratings for this species.

IV. Explanation of Rating.

A. Natural History. This species occurs along intermittent streams or meadow edges in mixed evergreen forest and white fir communities from 3000 to 5000' elevation. It is typically less frequent in riparian shrub and openings of forests, usually occupying upper slopes and ridgetop saddles with north aspect. *Bensoniella oregona* is most commonly associated with *Senecio triangularis*, *Mitella ovalis*, *Viola glabella*, and *Asarum caudatum* (Lang, 1988). It appears to tolerate some disturbance, if subsurface drainage is not altered; populations along streams without cover in clearcuts are very small. According to Copeland (1980, in Lang 1988) *Bensoniella oregona* occurs within very specific meadow and stream edge habitat on soils derived from ancient sedimentary rocks; soil depth, soil moisture, and climate are other critical factors in the distribution of this species. Of these factors, soil moisture may be most important.

Bensoniella oregona is at risk due to narrow ecological requirements, restricted range, and small population sizes (Lang, 1988). Seedlings and immature plants were not observed by Lang (1988) during extensive field work. Insects visiting the plants have been rarely observed, pollination mechanisms are unknown.

B. Past Actions. *Bensoniella oregona* communities have been impacted by timber harvesting, grazing, road construction, and maintenance (Copeland, 1980). Fire suppression may have negatively affected this species.

C. Species Range. *Bensoniella oregona* is a coast range species occurring in Douglas, Josephine, and Curry Cos, Oregon and Humboldt Co and Del Norte Cos., California. There are two main foci in Oregon. All but 15 of known populations are on Siskiyou NF; two sites are on Roseburg District BLM. In Oregon, the Heritage Program has 68 known occurrences (Kagan, 1993); only 6 or 7 populations are known from California. One California population was reported to lack vigor (Copeland, 1980); other populations are apparently small.

D. Non-habitat Factors. None identified

E. Features of the Alternative. Fire management may be important for this species. Element occurrences were not plotted on the species map, although California and Oregon Natural Heritage Programs do track this species. Riparian standards and guidelines were an important consideration in rating the alternatives. Most populations are within marbled murrelet range (within 50 miles of saltwater).

VI. Cumulative Effects Assessment. In California, only one population known from federal lands (Six Rivers NF), others privately owned. Cumulative effects were considered very important for this species. Forest Practices Act Standards and Guidelines provide inadequate protection for this species. If it is not currently listed as a state sensitive species, it should be proposed.

VI. Summary. During the FEMAT process, *Bensoniella oregona* was rated in two different portions of its range, Oregon and California, because of the considerable differences in population viability and likelihood of the four outcomes. The ratings for California reflect a bleak outlook for a species known only from one population on federal land in California. The ratings for this species in Oregon were higher, with the species passing the screens in

this portion of its range. Mitigation measures for this species are most important in California, but additional protection in Oregon may be warranted to compensate for declining California populations.

VII. Mitigation. Effectiveness of the mitigation on populations in California is unknown, but could be better assessed with input from individuals listed below. The Oregon portion of the range would benefit significantly from the proposed mitigation.

A. Geographic Extent. Klamath Provinces of Oregon and California Documented from Siskiyou (20 sites) and Six Rivers National Forest (1 site), Roseburg (2 sites) and Medford Districts, BLM.

B. Specific Habitats. Meadows and stream edges typically adjacent to late-successional and old-growth Douglas-fir forest.

C. Mitigation Measures.

- Conduct thorough inventory of potential habitat, particularly in California to locate additional populations and protect known sites. Lang (1988) reports that it is considered unlikely that many more populations will be discovered on Siskiyou NF, but additional inventories are warranted north of the Rogue River.
- Establish *Bensoniella*-Roosevelt Elk Scenic Area as recommended in Draft Species Management Guide.
- Acquire private populations through land exchanges in California. Most of the known populations are on nonfederal lands.
- Protect streams, seeps, meadows, and lake margins at known sites to maintain soil moisture at levels necessary to sustain *Bensoniella* populations. This species may be sensitive to changes in hydrology, but occurs in small wetlands and seeps that are not afforded protection under alternative 9.
- Update, sign, and implement rangewide Conservation Strategy to provide management guidelines maintain viable populations and enhance habitat in California.

Research:

- Investigate the role of fire on the establishment and persistence of this species. At least one population has been burned and may provide useful information on response to fire. Two sites have been identified as potential areas to experimentally introduce fire (Stansell, pers. comm.). Natural successional processes would keep these areas open and glade-like, but are now starting to close in (L. Wolf, pers. comm. 1993).
- Conduct autecological studies to determine critical habitat elements, in order to effectively manage for the species.

D. Benefits. The extremely limited number of extant sites in California indicates that this species may continue to be restricted to refugia despite heroic measures to protect all known sites. It may not be possible to offset expected results from nonfederal lands. Until more complete inventories are conducted (including state and private land) it is difficult to assess the long-term future of this species in California.

References:

- Copeland, W. 1980. *Bensoniella oregona*: Field study and status report. Final Summary. USDA Forest Service. Six Rivers National Forest, Eureka, Calif..
- Lang, F.A. 1988. Species management guide for *Bensoniella oregona* (Abrams and Bacig.) Morton. Prepared for Siskiyou National Forest, Grants Pass, OR.

Knowledgeable Individuals:

Frank Lang, Southern Oregon College, Medford, Oregon.
Veva Stansell, Gold Beach RD, Siskiyou National Forest, Gold Beach, Oregon.
Lisa Hoover, Six Rivers National Forest, Eureka, Calif.
Russ Holmes, Roseburg District, BLM, Roseburg, Oregon.
Bruce Rittenhouse, Coos Bay District BLM, Coos Bay, Oregon.
Joan Seevers, Medford District BLM, Medford, Oregon
Barbara Mumlo, Applegate RD, Rogue River NF, Jacksonville, Oregon.

I. Species. Mingan moonwort, gray moonwort (*Botrychium minganense*) Victorin

II. FEMAT Rating. 30-50-20-0

There was some discussion during the first panel meeting as to whether this species should be considered closely associated with late-successional and old-growth forests. It exhibits wide ecological amplitude, occurring in a wide range of habitats, particularly east of the Cascades, where it occurs on open shrubland, barren slopes. However, in the area under consideration, it typically occurs in older forest stands. Marked morphological and habitat differences between Wallowa plants and those occurring in the Cascades (Wagner, 1992) provided the justification for inclusion on the list.

III. Modifications due to changes in Alternative 9. None

IV. Explanation for Rating.

A. Natural History. This species belongs to a taxonomically difficult group of inconspicuous plants, the grapeferns or moonworts, which are easily overlooked. Several Challenge Cost Share projects within Region 6 have resulted in new taxonomic treatments and draft Conservation Strategies (e.g., Zika, 1992; Wagner, 1992). Increased focus on these species within the agency botany program has resulted in increasing numbers of sitings of this species. This has led to the recommendation that it be deleted from the Washington Natural Heritage Program Rare plant list.

Botrychium minganense is often found in riparian zones with old-growth *Thuja plicata* (Zika, 1992). Dense shade, mesic to moist or saturated soil, and gentle slopes are

typical site characteristics for the Mt. Hood NF, although the species may occur in diverse habitats including mossy talus slopes under *Acer macrophyllum* and more open, sandy or rocky areas.

Zika (1992) states that there is no data on the minimum viable population size for any *Botrychium* species, however, life cycle and genetic studies suggest that relatively small populations are viable. In his Conservation Strategy for the Mt. Hood NF, he suggests that, from a conservation standpoint, significant populations of *Botrychium minganense* are 40 or more stems.

B. Past Actions. Many Oregon populations have been threatened by logging, grazing, and recreation (Zika, 1992). The past effect of these activities is unknown.

C. Species Range. Endemic to North America, but wide-ranging across Canada, from coast to coast. In the U.S. it occurs in Alaska, Washington, California, Arizona, Idaho, and east to Michigan and Vermont (Zika 1992). Several new Oregon sites were discovered in 1993 (Kagan, pers. comm.).

D. Non-habitat Factors. Herbivory by deer is common, but significance is unknown.

E. Features of the Alternative. Eight of the nine populations mapped within the range of the northern spotted owl were within the reserves. Only Option 1 was considered to have lower probability of resulting in the restriction of this species to refugia, due to the inclusion of the late-successional and old-growth fragments. Based on analysis using more current data (12/23/93) for the Mt. Baker Snoqualmie NF, the five documented populations fall within administrative, congressional, or late-successional reserves.

VI. Cumulative Effects Assessment. This species occurs occasionally on private lands, but insufficient information is available for cumulative effects analysis. All documented Washington populations are on Forest Service land, but this probably reflects a higher survey intensity on federal lands.

VI. Summary. Reevaluation of ratings for *Botrychium minganense* may be warranted in light of recently discovered populations in Washington. Based on analysis using the most current data for the Mt. Baker Snoqualmie NF, none of the populations fell outside of reserves. Reanalysis of the entire area under consideration was not possible, but it may be likely that many of the newly discovered populations are afforded protection under alternative 9. However, mitigation measures will be necessary until a rangewide reanalysis is completed.

VII. Mitigation. Mitigation would increase ratings.

A. Geographic Extent. Throughout range. Documented from Willamette NF, and Forests of western Washington (Gifford Pinchot and Mt. Baker Snoqualmie)

B. Specific Habitats. Riparian and mesic sites

C. Mitigation Measures.

- Conduct systematic inventory to locate additional populations
- Protect known sites with a minimum of 300' buffers or three site potential tree heights, whichever is greater, unless topography dictates narrower buffer will be as effective in maintaining microclimate
- Conduct long term monitoring of populations including
- trend studies following disturbance
- tagging individuals within a site with different species of *Botrychium* to investigate changes in individual morphology over time
- baseline study in undisturbed large populations on Mt. Hood National Forest, as per Conservation Strategy

See monitoring guidelines in the Draft Conservation Strategy for the Mt. Hood NF and ongoing studies on the Mt. Baker Snoqualmie NF.

- Establish Botanical Special Interest Area on Mt. Hood N.F., as per Conservation Strategy.

D. Benefits. Monitoring studies will be effective in determining how much protection is required to maintain viable populations of this and related species of grapeferns. Because other *Botrychium* species often occur sympatrically, protecting known sites of *B. minganense* will likely protect additional species of grapeferns, many of which are included on the Regional Forester's list of Sensitive Species for Region 6.

References:

- Wagner, D.H. 1992. Guide to the species of *Botrychium* in Oregon. Unpublished report prepared under the Challenge Cost Share program between the University of Oregon and Mt. Hood NF.
- Zika, P.F. 1992. Draft Management Guide for rare *Botrychium* species (moonworts and grapeferns) for the Mt. Hood National Forest. Unpublished report.

Knowledgeable Individuals:

David Wagner, Eugene, Oregon.
Peter Zika, Oregon Natural Heritage Program, Portland, Oregon.
Ed Alverson, The Nature Conservancy, Eugene, Oregon.
Warren H. Wagner, University of Michigan, Ann Arbor, Michigan.
Laura Potash, Mt. Baker Snoqualmie NF, Mountlake Terrace, Washington.
Lois Kemp, Mt. Hood NF, Gresham, Oregon.
Kathy Ahlenslager, Colville NF, Colville, Washington.
Karl Urban, Umatilla NF, Pendleton, Oregon.

- I. **Species.** Mountain grape-fern (*Botrychium montanum*) W. Wagner
- II. **FEMAT Rating.** 30-50-20-0
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation for Rating.**

A. **Natural History.** Of all the grapeferns considered, *Botrychium montanum* is the species most closely associated with late-successional and old-growth habitat. It typically inhabits *Thuja plicata* swamps. Unlike *B. minganense*, which occurs throughout North America, this species is endemic to western North America and is considered rare throughout its range.

Botrychium montanum is the smallest of our moonworts and may be confused with juvenile individuals of related species (Wagner 1992). There has been a great increase in the number of documented sitings in Washington in recent years.

Certain species of fungi are necessary for establishment and survival. It may be the fungal symbiont in the *Botrychium* roots that is most affected by changes in canopy coverage, summer temperature, and soil moisture (Zika 1992). There is evidence to suggest there may also be a mycorrhizal association between western redcedar and *Botrychium*.

Zika (1992) states that there is no data on the minimum viable population size for any *Botrychium* species, however, life cycle and genetic studies suggest that relatively small populations are viable. In his Conservation Strategy for the Mt. Hood NF, he suggests that, from a conservation standpoint, significant populations of *Botrychium montanum* are 45 or more stems.

B. **Past Actions.** Logging has reduced habitat.

C. **Species Range.** Endemic to western North America. Populations documented from Montana, Washington, Oregon, California, and British Columbia. In Washington this species has been documented from the following counties within the range of the northern spotted owl: Chelan, Okanogan, Pierce, Skagit, Snohomish, Whatcom.

D. **Non-habitat Factors.** None noted

E. **Features of the Alternative.** Streamside buffers were considered highly important for this species; options 7 and 8 were rated lower because of reduced riparian buffers. Riparian buffers along intermittent streams prescribed for Option 9 do not afford adequate protection.

A total of five populations from Oregon were known during the panel ratings, with two occurring within Reserves.

- VI. **Cumulative Effects Assessment.** All populations documented from Washington are in

Forest Service ownership; however this probably reflects a higher survey intensity on federal lands.

VI. **Summary.** Ratings reflected the limited number of sitings, the close association with old-growth. Only Option 1 was rated higher, due to the inclusion of small late-successional and old-growth fragments. It is likely that additional populations will be discovered during inventories. Analysis using more current data (12/23/93) shows six populations on the Mt. Baker Snoqualmie NF are within late-successional reserves, one is within an administrative withdrawal, and five populations are within the matrix (near reserve boundary).

VII. **Mitigation.** Mitigation measures could increase ratings.

A. **Geographic Extent.**

B. **Specific Habitats.** On the Mt. Hood NF, *Botrychium montanum*, grows between 3200 and 4100' in deep shade under old-growth stands of *Thuja plicata*. Most populations occur near the upper ends of small tributaries and along headwater springs, on gentle slopes, on alluvium with dense duff layer. Soils are typically fertile and mesic.

C. **Mitigation Measures.**

- Conduct systematic inventories to further delineate species range and locate additional populations.
 - Protect significant populations using adequate buffers (minimum of 300' or three site potential tree heights, unless site topography dictates smaller buffers will be adequate). Narrow buffers around populations result in windthrow, increased isolation, drying of microsites, and invasion by dense shrubs which outcompete *Botrychium montanum* (Zika 1992).
 - Known sites occur in deep shade and maintenance of light regime is important for this species. Wetland hydrology should not be disturbed; most sites have saturated soil.
 - Protect *Thuja plicata* on known sites; there is evidence to suggest there may be a mycorrhizal association between western redcedar and *Botrychium*
 - Conduct long term monitoring of populations including
 - trend studies following disturbance
 - tagging individuals within a site with different species of *Botrychium* to investigate changes in individual morphology over time
 - baseline study in undisturbed large populations to compare with other managed sites
- See monitoring guidelines in the Draft Conservation Strategy for the Mt. Hood NF and ongoing studies on the Mt. Baker Snoqualmie NF.
- Establish Botanical Special Interest Area as per Mt. Hood N.F. Conservation Strategy
 - Caution should be used in application of controlled fire, and not done at risk of large populations.
 - Livestock grazing may have an adverse effect on *B. montanum*, populations should be monitored and grazing restricted if it is adversely affecting population.

D. **Benefits.** Other riparian inhabiting plants and animals would benefit from

additional protection of headwater habitat. Other *Botrychium* species often co-occur and would be afforded protection.

References:

- Wagner, D.H. 1992. Guide to the species of *Botrychium* in Oregon. Unpublished report prepared under the Challenge Cost Share program between the University of Oregon and Mt. Hood NF.
- Zika, P.F. 1992. Draft Management Guide for rare *Botrychium* species (moonworts and grape-ferns) for the Mt. Hood National Forest. Unpublished report.

Knowledgeable Individuals:

David Wagner, Eugene, Oregon.
Peter Zika, Oregon Natural Heritage Program, Portland, Oregon.
Ed Alverson, The Nature Conservancy, Eugene, Oregon.
Warren H. Wagner, University of Michigan, Ann Arbor, Michigan.
Laura Potash, Mt. Baker Snoqualmie NF, Mountlake Terrace, Washington.
Lois Kemp, Mt. Hood NF, Gresham, Oregon.
Kathy Ahlenslager, Colville NF, Colville, Washington.
Karl Urban, Umatilla NF, Pendleton, Oregon.

I. Species. Redwood beadlily *Clintonia andrewsiana* Torrey

II. FEMAT Rating.

A	B	C	D
70	27	3	0

III. Modifications due to changes in Alternative 9. Shortening of the rotation length could reduce projected likelihood that this species would be well distributed under alternative 9. Because most of the area within this species' range is on state and private land, modification of the State Forestry Practices Act could affect viability of this species.

IV. Explanation for Rating.

A. Natural history: Perennial herb inhabiting shaded, damp redwood forest, typically in shrubby understory with *Vaccinium ovatum*. Flowers in May-July, fruits in July-September.

B. Past actions: Accelerated harvest of coastal redwood forests (much of which is privately and state owned) has reduced populations of this species and its habitat.

C. Species range: Klamath ranges, north and central Coast Ranges, west to San Francisco Bay area, outer south coast ranges, from Smith River south. Del Norte County south to Monterey Co. Reported historically from southwestern Oregon, but not recently documented from Oregon.

D. Non-habitat factors: Since the species is restricted to the coastal fog belt, potential climate change may be a significant factor influencing long-term viability.

E. Features of the alternative:

V. Cumulative Effects Assessment. Little of the habitat for *Clintonia andrewsiana* is under federal ownership, populations occur primarily in Redwood National Park, with some habitat on Six Rivers National Forest. Most of species range is on private land, with some in state parks and on BLM land. Harvesting of redwood forests has posed viability risk: habitat acquisition or strengthening of California State Forestry Practices Act to eliminate old-growth redwood harvest or lengthen rotation significantly would be important to increase viability.

VI. Summary. This species was included for further analysis due to the differences in ratings between the first and second panels and the shortening of the rotation length in California. Strong concerns were expressed for this species during the first panel meeting. Further review of this low elevation coastal California endemic is warranted.

VII. Mitigation. Increasing rotation length in coastal California and/or site specific protection could increase ratings.

A. Geographic Extent. California Coast province includes most of the range of the species.

B. Specific Habitat. Low elevation redwood forest.

C. Mitigation Measures.

- Conduct more thorough investigations to evaluate the distribution of this species on federal land and nonfederal lands and determine the degree of protection necessary to maintain viability.
- Conduct systematic surveys to locate additional populations.
- Protect known populations.
- Acquire habitat through land exchanges.
- Lengthening the rotation of redwood forests within the range of the species would provide an alternative to the more intensive survey and protect strategy.

D. Benefits. Protection of *Clintonia andrewsiana* habitat would also afford protection to *Scoliopterus bigelovei*.

References:

Becking, R.W. 1982. Pocket flora of the Redwood Forest. Island Press, Covelo, California.

Hickman, J.C. (editor). The Jepson Manual Higher Plants of California. University of California Press, Berkeley.

Knowledgeable Individuals:

Julie Nelson, Shasta Trinity National Forest, Redding, Calif.

I. Species. Spleenwort-leaved goldthread (*Coptis asplenifolia*) Salisb.

II. FEMAT Rating. 0-10-90-0

II. Modifications due to changes in Alternative 9. none

IV. Explanation for Rating.

A. Natural history: Within the range of the northern spotted owl in the U.S., *Coptis asplenifolia* is strongly associated with old growth, found only in very old stands. Only a few sites are known. It occurs in moist woods and bogs, in very cool, wet, shady habitat, in cedar and hemlock stands with heavily mistletoed western redcedars nearby. Microhabitats occupied by *Coptis asplenifolia* include duff or litter, rock outcrops, mineral soil, seeps, and thick beds of moss. Of the four sites on the Mt. Baker Snoqualmie NF, three occur in old old-growth and have a thick duff layer and canopy of *Tsuga heterophylla* and *Thuja plicata*. These sites are close to water. A fourth site occurs on a rocky north-facing slope. Two collections from the coast range of Oregon (Tillamook and Clatsop Counties) from 3000-3600' elevation, (deposited in the OSU Herbarium) match the species morphologically, although the latter is somewhat intergradient toward *C. laciniata* (Chambers, pers. comm. 5/3/93).

B. Past Actions. Harvest of the very old stands in the coast range have likely extirpated many populations; however historic range is unknown. It is likely that the Oregon populations represent glacial relict populations.

C. Species Range. Alaska to Vancouver Island and Snohomish Co., Washington (Hitchcock and Cronquist 1973). Six sites in Washington state in the Olympic Peninsula and Washington Cascades. *Coptis asplenifolia* occurs in *Tsuga heterophylla*, *Thuja plicata*, and *Abies amabilis* vegetation series, typically in uneven aged stands of old-growth. In Washington, elevation ranges from 360 to 3,000'; on the Mt. Baker Snoqualmie NF, 1,200-3,000'.

D. Non-habitat Factors. Due to the small, scattered populations of this species within the area under consideration, even with maximum protection there is still risk to the species due to extremely limited opportunity for gene exchange. The higher elevation sitings of this species in Oregon suggests that it may be influenced by climate, limited

to colder temperatures, and may be affected by global climate change.

E. Features of the Alternative. Marbled murrelet recommendations afford protection to known populations and habitat.

VI. Cumulative Effects Assessment. Because the two currently known populations in Oregon occur on state-owned land, there are cumulative effects concerns for this species in Oregon. Additional populations are most likely to occur in the Tillamook State forest and parks and adjacent privately owned land.

VI. Summary. The ratings reflect the limited number of known sites and the close association of *Coptis asplenifolia* with very old stands. Recent analysis using newly available data from the Mt. Baker Snoqualmie NF (12/23/93) indicates that 4 populations occur within late-successional reserves and one on boundary of an administrative withdrawal.

VII. Mitigation. Although Oregon collections were made in 1971 and 1980, this species has not been included in Oregon Natural Heritage Program rare plant lists. Due to the extremely limited number of known sites of both *C. asplenifolia* and *C. trifolia*, it may be appropriate to include this species on the Oregon Natural Heritage Program list of taxa endangered in Oregon, but more common or stable elsewhere. Because it is evergreen and can be readily identified vegetatively, surveys will be highly effective in delineating additional populations. This species should be included in the "Species of Concern" list prepared during Watershed Analysis for all Watersheds in the northern Oregon coast range and field surveys conducted to locate additional populations. All populations of this species should be protected.

A. Geographic Extent. Provinces: Oregon Coast Range, Washington Cascades, and Olympic Peninsula

B. Specific Habitats. Bogs and moist, shady habitat within late-successional and old-growth stands.

C. Mitigation Measures.

- Conduct inventories during Watershed Analysis of all high probability habitat.
- Protect all known populations and maintain habitat at existing sites. Avoid soil and litter disturbance and protect the deep duff layer typically present. Maintain existing hydrology and light regimes of sites.
- Prepare Conservation Strategy with specific guidelines for management of this species.

D. Benefits. Mitigation may be unsuccessful in maintaining viable populations of this species in Oregon, due to the relictual nature of the populations. The areas in which this species occurs in this portion of its range are floristically unique and offer opportunities to study biogeography, disjunctions, and climatic factors limiting to distribution. Protection of populations in Washington may also benefit *Galium kamtschaticum* and marbled murrelets, which co-occur at some sites.

References:

Klinka, K., V.J. Krajina, A. Ceska, and A.M. Scagel. 1989. Indicator plants of coastal British Columbia. Univ. of British Columbia Press, Vancouver.

Knowledgeable Individuals:

Laura Potash, Mt. Baker Snoqualmie NF, Mountlake Terrace, Washington.

Jan Henderson, Mt. Baker Snoqualmie NF, Mountlake Terrace, Washington.

Ken Chambers, Oregon State University, Corvallis, Oregon.

I. **Species.** Threelob Goldthread (*Coptis trifolia*) (L.) Salisb.

II. **FEMAT Rating.** 20-30-50-0

Panel rated viability of disjunct populations, not species.

III. **Modification due to changes in Alternative 9.** None

IV. **Explanation for Rating.**

A. **Natural History.** Disjunct populations of this species were recently discovered in Oregon. In the Pacific northwest, *Coptis trifolia* inhabits perimeters of small wetlands or swamps within mature and old-growth in *Pseudotsuga menziesii* vegetation series. Dominant trees are almost always *Pseudotsuga menziesii*. It occurs on dead wood.

B. **Past Actions.** Unknown

C. **Species Range.** *Coptis trifolia* occurs in deep woods from Alaska to Vancouver Island, and southern British Columbia, Japan and Siberia. According to Gleason and Cronquist (1963), this species ranges from Greenland to Alaska and eastern Asia, south to New Jersey, North Carolina, northern India, Iowa, and Idaho. The American plants are segregated on minor characters as var. *groenlandica* (Oeder) Fassett.

Two populations have been documented from Oregon; no populations are known from Washington.

D. **Non-habitat Factors.** This species has medicinal properties for which it is collected and marketed, which could threaten local populations.

E. **Features of the Alternative.** Small wetlands were considered particularly important for *Coptis trifolia* and options which did not protect these special habitats were not considered adequate for this species. Because of the lack of complete inventory data for this species and the significance of the disjunct populations, the additional protection afforded by late-successional and old-growth fragments resulted in considerably higher ratings. Of the two populations known from Oregon, one was within a LSOG2 reserve and the other was in a Key Watershed, but off federal land.

VI. **Cumulative Effects Assessment.** State, private, and Warm Springs Indian Reservation lands may contain additional populations of this species in Wasco County. Management of these lands could affect future viability of the disjunct Oregon populations, although the extent will remain unknown until inventories are complete.

VI. **Summary.** Only two populations of *Coptis trifolia* have been documented within the area considered, but the ratings reflected an optimism that additional populations would be discovered. Protection of small wetland habitats within late-successional and old-growth forests was considered key for this species.

VII. **Mitigation.** Implementation of mitigation measures could elevate the ratings somewhat, but would likely always reflect the uncertainty future of disjunct populations.

A. **Geographic Extent.** Eastern Oregon Cascades Province. Documented from Mt. Hood National Forest.

B. **Specific Habitats.** In Oregon, it occurs in meadows within *Abies amabilis* zone, scattered around perimeter of swamps dominated by *Thuja plicata*, *Pinus monticola*, *Tsuga heterophylla*, *Picea engelmannii*, *Kalmia*, and *Alnus incana*.

C. **Mitigation Measures.**

- Conduct inventories of high probability habitat
- Protect all known sites
- Prepare Conservation Strategy to provide management guidelines

D. **Benefits.** It is likely that additional populations will be discovered. Protection of small wetlands will probably be effective in maintaining individual populations.

Knowledgeable Individuals:

Lois Kemp, Mt. Hood NF, Gresham, Oregon.
Rich Helliwell, Ochoco National Forest

I. **Species.** Cold-water corydalis (*Corydalis aquae-gelidae*) Peck and Wilson

II. **FEMAT Rating.** 10-48-40-2

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** The natural history of *Corydalis aquae-gelidae* is well described in Goldenberg (1990) and Gamon (1983). As the name implies (*aquae-gelidae*, translated, means cold-water), this species is restricted to cold, flowing streams. Substrate temperature averaged 10⁰ C for 75 sample plots occupied by *C. aquae-*

gelidae on the Mt. Hood NF (Goldenberg, 1990). Streams inhabited by this species are almost always perennial, but not necessarily fish-bearing. Large areas of apparently suitable habitat within the known range of the species are unoccupied (Goldenberg, 1990; Gamon, 1991).

Corydalis aquae-gelidae occurs within an elevational range of 1220-4260'. In Oregon, cobble or gravel bars provide the largest areas of suitable conditions (Goldenberg, 1990). In Washington, a majority of sites have a northerly aspect. In Oregon, the typical substrate has greater than 50 percent gravel, with coarse sand filling the interstices. *Corydalis aquae-gelidae* seems most successful under high canopies which allow light penetration (Goldenberg 1990). It does not tolerate understory competition.

Corydalis aquae-gelidae reproduces by seed only; it does not spread rhizomatously. Bumblebees are probably the main pollinators. Seed production is higher than for related *C. scouleri*. Seeds are ejected forcibly from capsules, sinking in water once surface tension is broken. Seed viability may be lost after dessication (Guerrant, pers. comm.). Herbivores include slugs, deer and elk.

Establishment requirements for seedlings may be much narrower than the habitat requirements for mature adults (Goldenberg, 1990). Water deeper than 10 cm during the growing season precludes establishment.

When under stress, this species may succumb to a host-specific powdery mildew, probably *Peronospora corydalis*; this pathogen has been noted most frequently at lower elevations and where canopy cover is lowest, indicating that it may require warmer temperatures (Goldenberg, 1990).

B. Past Actions. Hydroelectric projects (e.g. Stone-Shellrock Hydropower project , Lake Harriet dam), timber harvest, road-building, and fish habitat improvement projects have resulted in losses of individuals and habitat for this species.

C. Species Range. *Corydalis aquae-gelidae* has a limited range extending from the upper Clackamas River in Clackamas Co., Oregon to Multnomah Co., and in Clark and Skamania Cos. in Washington. Recently discovered (6/14/93) populations in Marion and Linn Cos., Oregon represent significant southern range extensions. Most populations are on federal lands.

D. Non-habitat Factors. Related members of the genus have medicinal uses.

E. Features of the Alternative. Panel members observed that many populations of *Corydalis aquae-gelidae* occur in Reserves and key watersheds; however, subsequent analysis revealed that approximately 67% of known populations actually occur within the Matrix. Concerns were expressed regarding southern populations on BLM land in Oregon. Riparian buffers were the most significant factor considered in rating the alternatives. Panel members were uncertain what comprised an adequate stream buffer width; a minimum of 300' was considered by some to be necessary to moderate effects of microclimate and minimize windthrow. Because some of the largest

populations occur in headwaters, buffer widths prescribed for Option 9 (both within and outside of Key Watersheds) on intermittent streams were considered inadequate. Concerns were also expressed that any option that allows salvage logging could present a risk.

VI. Cumulative Effects Assessment. Few populations occur on non-federal lands. Cumulative effects were not considered important for this species. All populations in Washington occur on the Gifford Pinchot National Forest (J. MacMillan 12/13/93).

VI. Summary. The ratings reflected the importance of riparian protection to this species which is restricted to cold flowing streams on the Mt. Hood and Gifford Pinchot National Forests and nearby BLM land. The largest populations occur in undisturbed old-growth, often in perennially wet stream headwaters.

VII. Mitigation. Ratings can be increased significantly with mitigation. Due to the narrow range of this species, site specific mitigation is can be easily accomplished. Specifically, increasing buffer width on headwaters and intermittent streams within the species' range would reduce likelihood of the species being restricted to refugia. Road closures that reduce sedimentation within the range of the species would be beneficial.

A. Geographic Extent. Documented from Gifford Pinchot and Mt. Hood National Forests and Salem District BLM.

B. Specific Habitats. Riparian, growing in or very near flowing water (e.g. rivers, spring-fed streams, and seeps)

C. Mitigation Measures.

- Continue inventory efforts to identify additional populations and better delineate known populations.
- Protect all known sites by implementing a minimum of a 300' buffer where site disturbing activity is prohibited. Specifically, avoid timber harvest, road-building, fisheries projects, recreational development, hydroelectric projects, and any other activities likely to affect site hydrology.
- Maintain existing hydrologic conditions, maintain stream channels and seeps in their existing physical condition, and maintain existing light conditions, as per Conservation Strategy for Gifford Pinchot NF (Gamon 1991).
- Update, sign, and implement Conservation Strategies for the Mt. Hood and Gifford Pinchot National Forests and develop Conservation Strategy to address BLM populations.
- Monitor trends of selected populations, as directed in the Draft Conservation Strategy for the Mt. Hood NF, throughout range of species
- Establish Botanical Special Interest Areas to protect large populations.
- Experimentally manipulate vegetation at selected sites to reduce canopy cover as per Conservation Strategy for Gifford Pinchot NF.
- Revisit known sites at 1 to 3 year intervals and document population trends and evaluate effectiveness of management treatments.

D. Benefits. Mitigation would eliminate likelihood of extirpation.

References:

- Gamon, J. 1991. Review of the Species Management Guide for *Corydalis aquae-gelidae* on the Gifford Pinchot NF.
- Goldenberg, D. 1990. Draft species management guide for *Corydalis aquae-gelidae* (Peck and Wilson). Unpublished report submitted to the Oregon Department of Agriculture for the Mt. Hood N.F.
- Goldenberg, Doug M. 1992. Ecology of *Corydalis aquae-gelidae*, a rare riparian plant. Unpublished M.S. thesis, Oregon State University.

Knowledgeable Individuals:

Doug Goldenberg (graduate student of Don Zobel, Oregon State, who conducted master's thesis project on this species), current address unknown.

Lois Kemp, Mt. Hood National Forest, Gresham, Oregon.

Nancy Fredricks, Gifford Pinchot NF, Vancouver, Washington.

Gale Masters, Estacada RD, Mt. Hood NF, Estacada, Oregon.

Bryce Smith, Clackamas RD, Mt. Hood NF, Clackamas, Oregon.

John Gamon, Washington Natural Heritage Program, Olympia, Washington.

Larry Scofield, Salem District BLM, Salem, OR.

Claire Hibler, Santiam Resource Area, Salem District BLM, Salem, OR.

Julie Thiel, Clackamas Resource Area, Salem District BLM, Salem, OR.

I. Species. Clustered lady's slipper (*Cypripedium fasciculatum*)

II. FEMAT Rating. Cascades province 0-8-37-55
Klamath province 0-43-38-20

III. Modifications due to changes in Alternative 9. Clarification of fire management guidelines could increase ratings, since concerns regarding fire suppression were raised during panel discussions.

This species is very long-lived and may be slow to establish. Shortening the rotation length in California could reduce ratings.

IV. Explanation for Rating.

A. Natural History.

Reproductive biology

Although *C. fasciculatum* is self-compatible, it requires a biotic vector for successful pollination (Harrod and Knecht, in preparation). Although no pollinator has been

determined for this species, it is suspected that a species of bumblebee (*Bombus* sp.) is required. The bilateral symmetry of the flowers is quite typical of those pollinated by bees in general, and bumblebees have been observed going to *C. montanum*, which has a similar shaped flower. Kagan (1990) suggests that beetles might be the pollinators, but this is unlikely since beetles often eat flower parts and pollinate incidentally. The specific shape of this species' flowers suggests coevolution between a constant pollinator able to recognize shapes.

Genetic Variation and Population Importance

Preliminary results of a genetic analysis by Aagaard et al. (in preparation) show that there is little genetic variation among populations on the Leavenworth Ranger District on the Wenatchee NF. This suggests that the species is an outcrosser (which is consistent with Harrod and Knecht, in preparation) and that there is a considerable amount of gene flow between populations (at least the ones that were sampled). In addition, there was basically no genetic variation within "clusters" of aerial stems suggesting that clusters of stems belong to the same individual (genets). This is consistent with the findings of Harrod (in preparation) that groups of aerial stems arise from a common rhizome.

Kagan (1990) suggested that in southwest Oregon one could ignore small populations as long as a certain number of large populations were maintained within a given area. The fact that there is little genetic variation within this species suggests that all populations would be important to prevent it from becoming extirpated. Little genetic variation may also limit adaptability increasing likelihood that human mediated changes to sites may eliminate individuals. Small populations are important in that they may represent the extremes of the species ecological tolerance for environmental factors. Unique alleles may be present in these individuals which would allow for the maintenance of the species during periods of climate change. In some cases, small populations may simply be founder individuals which haven't reached reproductive maturity. Harrod (in preparation) has found that small, non-flowering plants can at least be 12 years old and perhaps older. It may take up to 20 years before a seedling reaches reproductive maturity. Harper and White (1974) note that *C. calceolus* require 13 to 16 years growth before flowering.

Harrod and Everett (in preparation) have recently developed a model to predict seed dispersal. This model suggests that seed dispersal is relatively limited (i.e. 43 inch dispersal distance in a 10 mile an hour wind), which is consistent with preliminary results presented by Harrod and Everett (1993).

B. Past Actions. Fragmentation of habitat, fire suppression, trampling, and collection of plants for horticultural purposes have contributed to population declines. Losses due to timber harvest have been documented in California.

C. Species Range. *Cypripedium fasciculatum* is a rhizomatous, perennial orchid with a fairly broad distribution in the western U.S. It occurs from Washington to California and in scattered locations in Idaho, Montana, Colorado, Wyoming and Utah. It is currently considered threatened or sensitive in most states and is listed as a category 2 species in the most current publication of the Federal Register (Vol. 58,

No. 188; September 30, 1993).

D. Non-habitat Factors. This species (and other relatives) have been popular in the horticultural trade, cultivated in England since the early 1900's (Correll 1950). It continues to be threatened by collectors.

E. Features of the Alternative. Important factors in the rating of this species included overall amount of forest in the matrix, specific distances protected for different stream classes, the size and location of individual reserves and their overall acreage, and the quality of habitat within the reserves. Approximately one-third of known populations within the area considered occur in reserves.

VI. Cumulative Effects Assessment. The role of non-federal lands was not considered an important factor for this species, since most populations are known from federal lands.

VI. Summary. Populations of this species tend to be small and scattered and fire may play an important role in life cycle. Panel members indicated that investigations of the role of fire and prescribed burns could be important to the reducing the likelihood of extirpation of this species.

According to fire management standards and guidelines, a specific fire management plan will be prepared prior to any habitat manipulation activities in late-successional reserves and key watersheds. In Adaptive Management Areas, fire managers are encouraged to actively support opportunities for research on the role and effects of fire management on ecosystem functions. Because thirty-six percent of the documented populations occurred in Adaptive Management Areas, studies to investigate the role of fire for *Cypripedium fasciculatum* are strongly recommended within the Applegate AMA.

VII. Mitigation. Mitigation measures could significantly increase ratings

A. Geographic Extent. The mitigation measures presented here apply to the range of the species in the Cascade Mountains, central Washington to northern California.

B. Specific Habitats. *Cypripedium fasciculatum* occurs in a variety of habitats throughout the Cascade Range. In California, Barker (1983) notes that the habitat of *C. fasciculatum* cannot be closely defined. There is no restriction to parent material since populations have been found on ultrabasics, granitics, schist, limestone and quartz-diorite. Also, Fowlie (1988) notes occurrences of the species on serpentine landslides in northwestern California. Sites are dry or damp, rocky to loamy, and elevations vary between 1300 and 5300 feet (Barker 1983). Populations are found in areas with 60 to 100 percent shade provided by numerous plant communities including mixed evergreen, mixed conifer, Douglas-fir (*Pseudotsuga menziesii*) forests and pine (*Pinus* spp.) and black oak (*Quercus kelloggii*) forests (Barker 1983).

In Oregon, Kagan (1990) notes that the species occurs primarily in older Douglas-fir (*P. menziesii*) forests on old stream terraces. This report is consistent with site information from the Rogue River and Umpqua National Forests (Wayne Rolle, Forest Botanist, Rogue NF and Lisa Wolf, District Botanist, Umpqua NF, pers. comm.). The

largest populations in southwestern Oregon tend to occur on moist stream terraces, but others inhabit dry rocky upslope sites. Elevation ranges from 1000 to 3500 feet. Dominant trees include western hemlock (*Tsuga heterophylla*), white fir (*Abies concolor*), white oak (*Q. garryana*), bigleaf maple (*Acer macrophyllum*) and tan oak (*Lithocarpus densiflorus*). Understory associates include sword fern (*Polystichum munitum*), Oregon grape (*Berberis nervosa*), dogwood (*Cornus nuttallii*), hazel (*Corylus cornuta*).

In Washington, plant communities and habitats are different than those in Oregon and California. Harrod (1993; Harrod, in preparation) found that most populations on the Wenatchee NF occur in the grand fir (*A. grandis*) series, although populations can be found in the subalpine fir (*A. lasiocarpa*) and ponderosa pine (*P. ponderosa*) series. On nine sites that were sampled, 60 percent of all trees were four inches in diameter or less and 93 were 12 inches or less (Harrod 1993). Based on tree ring data, 12 inch diameter trees are approximately 100 years old, while trees 4-6 inches in diameter are about 80 years old. Tree densities were 212 and 285 trees per acre for grand fir and Douglas-fir, respectively. Tree age, size class and density suggest a long period of fire suppression. Also, average canopy closure was 62 percent, average slope was 30 percent, aspects were northerly and elevation varied from 2400 to 4300 feet. Dominant understory associates include ocean spray (*Holodiscus discolor*), Oregon grape (*B. nervosa*), pinegrass (*Calamagrostis rubescens*), vine maple (*A. circinatum*), kinnikinnick (*Arctostaphylos nevadensis*) and dwarf huckleberry (*Vaccinium myrtillus*; Harrod 1993; in preparation).

It is apparent that a distinct plant community for *C. fasciculatum* can not be determined. Obviously, for a species with a relatively broad distribution, one would expect to find the species occupying different communities or associations which vary over a geographic range. It is more likely that the habitats that this species occupies have similar characteristics, i.e. some degree of shading and relatively moist. Such characteristics may be important for one or more stages within the species life history. For example, Harrod (study in progress) hypothesizes that a species of fungus associated with deer or elk feces is required for seed germination. This hypothesis was developed after observing that all the *C. fasciculatum* sites on the Leavenworth, Lake Wenatchee and Cle Elum Ranger Districts on the Wenatchee NF occurred by or very near big game trails. There is also evidence that this is true in many other locations throughout the west.

Although trampling of populations by ungulates may be detrimental, big game animals may be important for long distance dispersal (and perhaps also seed germination) by transport of seed in digestive tracts. In fact, sighting form information on the Wenatchee NF and anecdotal reports for the Siskiyou NF and elsewhere have made mention of deer browsing on mature fruits (capsules): The dispersal and establishment of populations, then, is probably a function of a number of factors (establishment of fungal relationship, suitability of habitat for the fungal symbiont, fruit herbivory by big game animals, suitability of habitats for big game animals, etc.) and not necessarily dependent on associated species of a particularly plant community.

Therefore, it would seem that *C. fasciculatum* will occupy a broad range of habitats in the mid-mountainous region of the Cascade Range. Mitigation for this species must be generally applied across landscapes and should consider many related factors.

C. Mitigation Measures. Mitigation for *C. fasciculatum* must consider its biological and ecological requirements. The success of this species is dependent on the ability of certain critical stages in its life history to give rise to the next stages. Each one of these life stages may require specific mitigation.

Habitat

Ecosystem management philosophy provides a framework in which this species could be managed. In other words, if one manages for biodiversity within ecosystems (of which *C. fasciculatum* is a part), maintaining the natural range of variability for ecosystem processes, functions, structures and compositions, then this species will remain viable (provided that we assume that this species is not "naturally" declining; Harrod et al., in press). Furthermore, if the goal is to manage for biodiversity, then management for rare species, as well as other ecosystem components, is the emphasis or outcome (Harrod et al. 1993), and mitigation is not needed for this individual species. However, until we can effectively manage ecosystems in this manner, the following should be considered.

Field surveys beyond what is normally done for NEPA analysis are necessary. Ecological data should be collected at all new and previously located sites so that a complete demographical analysis can be conducted.

Fire is likely to have played an important role in the distribution and abundance of this species. Fire will be an important tool to manage this species' habitat, particularly in eastside forests. However, fire effects on this species needs to be studied. Kagan (1990) notes that hot fires in California appear to have eliminated populations present in the area. Harrod (in preparation) has found that *C. fasciculatum* produces buds at the ends of rhizomes during the current years growing season. These buds remain dormant 3 to 5 inches below the surface and then bolt early in the spring. A hot fire could potentially damage these buds, and even the entire rhizome, preventing new growth the next season. Under a periodic fire regime which promotes cool fires buds may become damaged, but the rhizome would likely survive giving rise to new buds in the following year(s). In areas where large numbers of populations are found, research projects need to be conducted to obtain specific information about this species' fire ecology. Until this information is obtained, populations should be protected from prescribed burns.

Since this species occurs in areas with an average degree of shading of about 60 percent (Harrod 1993; Harrod, in preparation), management activities such as logging or road building should not decrease shade at population sites. This requires leaving adequate buffers taking into consideration the potential for blow-down. Appropriate buffer widths will vary.

Physical disturbance of population sites should be avoided.

Seed Production

Managing for this species will require a knowledge of the pollinator and subsequent management of that species (or perhaps several species) to ensure seed production. For example, in 1993, Harrod and Knecht (in preparation) found that the total number of capsules produced was 31 percent of the number of flowers initially produced. This may vary by year, but Barker (1983) notes that fruit set is typically 25 percent or less. Elimination of a necessary pollinator(s) through management activities would prevent *C. fasciculatum* from reproducing sexually.

Seed Germination and Dispersal

Seed germination and seedling establishment are likely the most important factors in determining where this species will be found. Assuming that deer or elk are required for long distance dispersal and seed germination, viable big game populations within the range of *C. fasciculatum* are important. Thomas (1979) provides a framework for such management. Game trails that lead in and out of a given population should be maintained and unobstructed. Activities that might prevent big game animals from using game trails that may serve as dispersal corridors for *C. fasciculatum* should be avoided (e.g. road building, timber harvest).

D. Benefits. The results of these mitigation measures should result in the maintenance of this species over its range in the Cascades. The completion of current research projects and the resulting conservation strategy for this species will only strengthen management of this species.

The original rating in the FEMAT report indicated a 55 percent likelihood of extirpation in the Cascade province and 20 percent in the Klamath province. If the above mitigation is implemented, this figure should be reduced significantly.

Knowledgeable Individuals:

Richy Herrod, Leavenworth RD, Wenatchee NF, Leavenworth, Washington.
Charles Sheviak, New York State Museum, Albany, New York.
Jimmy Kagan, Oregon Natural Heritage Program, Portland, Oregon.
Lisa Wolf, North Umpqua RD, Umpqua NF, Glide, Oregon.
Barbara Williams Klamath NF, Yreka, California.
Joan Seevers, Medford District BLM, Medford, Oregon.

References:

- Aagaard, J.E., K. Shea and R.J. Harrod. (in preparation). Genetic variation within and among populations of the rare orchid, *Cypripedium fasciculatum*.
- Barker, L.M. 1983. Botanical investigation and management guidelines for *Cypripedium* species. U.S.D.A., Forest Service, Region 5, Klamath NF.
- Coleman, R.A. 1989. *Cypripediums* of California. American Orchid Society. 58(5):456-460.

- Fowlie, J.A. 1988. *Cypripedium fasciculatum* on serpentine landslides of northwestern California. Orchid Digest (July-Aug.-Sept.): 136-139.
- Harper, J.L. and J. White. 1974. The demography of plants. Ann. Rev. Ecol. Syst. 5: 419-463.
- Harrod, R.J. 1993. Habitats of *Cypripedium fasciculatum* on the Wenatchee NF. Unpublished Study.
- Harrod, R.J. (in preparation). Conservation strategy for *Cypripedium fasciculatum* (Orchidaceae) within the Cascade Range. U.S.D.A., Forest Service, Region 6, Wenatchee NF, Leavenworth RD.
- Harrod, R.J. and R. Everett. 1993. Preliminary observations on seed dispersal and seed production of *Cypripedium fasciculatum*. Northw. Sci. 67(2): 131.
- Harrod, R.J. and R. Everett. (in preparation). Seed characteristics and dispersal of *Cypripedium fasciculatum*.
- Harrod, R.J. and D. Knecht. (in preparation). Pollination ecology of *Cypripedium fasciculatum*.
- Harrod, R.J., W.L. Gaines, R.J. Taylor, R. Everett, and T. Lillybridge. (in press). Biodiversity in the Blue Mountains. In T. Quigley and R. Jaindl (eds.) Search for a solution - sustaining the land, people and economy of the Blue Mountains, a synthesis of our knowledge. U.S.D.A., Forest Service, Blue Mountains Natural Resources Institute, LaGrande, Or.
- Kagan, J. 1990. Draft species management guide for *Cypripedium fasciculatum* for southwestern Oregon. Oregon Natural Heritage Data Base, Portland, Or.
- Thomas, J.W. 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. Agric. Handbook No. 553. U.S.D.A., Forest Service. 511p.

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- I. Species. Mountain lady's slipper (*Cypripedium montanum*) Douglas
- II. FEMAT Rating. east Cascades province 0-25-75-0
west Cascades province 0-21-52-27
- III. Modifications due to changes in Alternative 9. Clarification of fire standards and guidelines may increase ratings for this species. This species is very long-lived and may be slow to establish. Shortening the rotation length in California could reduce ratings.
- IV. Explanation for Rating.

A. Natural History. Most *Cypripediums* are pollinated by bees (Catling and Catling 1991). There have been numerous reports that there used to be many more populations of *C. montanum* in western Oregon; but declines in population numbers have not been quantified. Today in Oregon, *Cypripedium montanum* populations are small and scattered; less than 20 are extant west of the Cascades. Because orchid populations may be typically small, a decline in numbers of populations may be more significant than the small size of populations. Small populations may reflect the slow establishment and growth rate of this species. However, small, declining populations may also indicate that specific management requirements are not being met. *Cypripedium montanum* seems to persist in areas which have been burned. The greater fire frequency east of the Cascades may be correlated to the greater number of extant populations in this area. *Aster vialis* is located in close proximity in two places, implying that these species may share similar fire history requirements. Unlike *Aster vialis*, however, this species persists under closed canopy and does not specifically require gaps.

Cypripedium montanum often grows sympatrically with *C. fasciculatum* and probably shares similar biological requirements. Specific fungi are required for germination and establishment; their presence may be more important than specific site characteristics (e.g. moisture, elevation).

B. Past Actions. Fire suppression, logging, and collection for the horticultural trade have resulted in extirpation of populations.

C. Species Range. Southern Alaska, British Columbia, Vancouver Island, and western Alberta, south to Montana, Idaho, Wyoming, and northern California. Not known from Olympic Peninsula and possibly not presently west of the Cascade crests in Washington, except along the Columbia River Gorge (Hitchcock et al. 1969). In Oregon, it has been documented from the following counties: Baker, Crook, Deschutes, Douglas, Grant, Hood River, Jackson, Jefferson, Josephine, Klamath, Lake, Lane, Marion, Morrow, Umatilla, Union, Wallowa, Wasco, and Wheeler.

D. Non-habitat Factors. This species (and other relatives) have been popular in the horticultural trade, cultivated in England since the early 1900's (Correll 1950). It continues to be threatened by collectors.

E. Features of the Alternative. Panel members felt this species is declining precipitously within the range considered, with the species' chance of recovery considered marginal without management intervention. They felt that the addition habitat in the late-successional and old-growth fragments were important to this species and only Option 1 would maintain future options. Because the species is slow-growing, even with the greatest habitat protection and management, it may take more than 100 years to recolonize and become well-distributed throughout its range. Active management is required for this species and panel members assumed that no additional standards and guidelines would be implemented when they rated this species. Some panel members felt that the chance of this species becoming well-distributed throughout its historic range would be very low within 100 years, even with specific standards and guidelines. The primary influencing factors were overall

acreage of reserves and their specific location, and the quality of habitat within the reserves.

VI. Cumulative Effects Assessment. Because this species is widely distributed and populations have been documented from state and private land, ownership patterns were considered important for this species, particularly in areas of patchwork ownership. One recently discovered population near Eugene occurs in a 60-70 year-old stand on private land.

VI. Summary. The ratings reflect the perceived precipitous decline of this species from its historic distribution within the range of the northern spotted owl and the requirements for specific standards and guidelines for management of this species.

VII. Mitigation. Implementation of specific management guidelines could significantly increase ratings for this species.

A. Geographic Extent. Throughout range of the species within the range of the northern spotted owl, including all Cascade provinces, and Klamath province.

B. Specific Habitats. *Cypripedium montanum* occurs within a rather broad range of habitats; specific moisture and temperature regimes may be less critical than the presence of specific symbiotic fungi. This species occurs at elevations ranging from 200-2000m. Habitats include moist sites near riparian areas to dry hillsides. Although habitat is exceedingly variable throughout the species range, it is consistent within different portions of its range, so it is possible to therefore to define habitat locally.

C. Mitigation Measures.

- Protect known populations
- Avoid hot fires by manual fuel removal or cool season fires
- Restore natural fire cycles
- Manage canopy closure to provide 60 percent shading
- Avoid surface disturbance, including raking of special forest products (e.g. truffles), hiking trails, logging of sites
- Develop Conservation Strategy to provide specific management guidelines for this species
- Investigate the disturbance ecology, including the role of fire in the germination and establishment of this species, conducting experimental burns in habitat. Timing of burns may be critical; cool season burns west of Cascades are unnatural, but removal of fuels may be necessary if natural season burns are conducted.
- Based on results of investigations, restore fire frequency and monitor population trends
- Develop cooperative relationships with private landowners and state agencies to manage this species

D. Benefits. *Cypripedium montanum* is often sympatric with other orchids. Conditions which favor this species are those beneficial to its fungal symbionts. Implementation of fire standards and guidelines would also benefit fire-dependent species including *Allotropa virgata*, *Aster vialis*, *Bensoniella oregona*, and *Pedicularis*

howellii.

References:

- Catling, P.M. and V.R. Catling. 1991. A synopsis of breeding systems and pollination in North American orchids. *Lindleyana* 6:187-210.
- Coleman, R.A. 1989. *Cypripediums* of California. *Amer. Orchid Society Bull.* 58:456-460.
- Sheviak, C.J. 1992. Natural hybridization between *Cypripedium montanum* and its yellow-lipped relatives. *Amer. Orchid Soc. Bull.* 546-559.

Knowledgeable Individuals:

Jimmy Kagan, Oregon Natural Heritage Program, Portland, OR.
Richy Herrod, Leavenworth RD, Wenatchee NF, Leavenworth, WA.
Joan Seevers, Medford District BLM, Medford, OR.
Nancy Wogen, Eugene District, BLM, Eugene, OR.
Charles Sheviak, New York State Museum, Albany, NY.

I. **Species.** Boreal bedstraw (*Galium kamtschaticum*)

II. **FEMAT Rating.** 0-70-30-0

Galium kamtschaticum reaches the southernmost extent of its range north of Snoqualmie Pass on the Mt. Baker Snoqualmie National Forest. There have been only 41 reports of this species in Washington (Potash 1/4/94). All occur on federal land, with one population in joint ownership with the Washington Department of Natural Resources (Washington Natural Heritage Program (12/93).

III. **Modifications due to changes in Alternative 9.** None

IV. **Explanation for Rating.**

A. **Natural History.** *Galium kamtschaticum* has narrow habitat requirements, restricted to seeps with nearly year-round saturated soil (Potash 1992). The majority of sites are in old-growth coniferous forests, but some populations have been documented from young plantations that have been clearcut. The species most commonly associated with this species include *Rubus spectabilis*, *Athyrium filix-femina*, *Oplopanax horridum*, *Ribes bracteosum*, and *Lysichiton americanum*.

B. **Past Actions.** Unknown

C. **Species Range.** *Galium kamtschaticum* has a circumboreal distribution, occurring

sporadically from Kamtchatka and Korea through the Aleutian Islands and the Alaska panhandle to the Olympic and Cascade mountains of Washington. It has not been reported south of Snoqualmie Pass. It reappears in southeastern Canada, and adjacent New England and New York state, and on the northeastern side of Lake Superior. It inhabits moist, cold coniferous woods, mossy places, and thickets.

D. Non-habitat Factors. Trampling was identified as a potential threat (Potash 1992).

E. Features of the Alternative. No alternative was rated with any projected likelihood that this species would be well-distributed throughout its range. Only alternatives 1, 2, and 3 received higher ratings; with 90 likelihood of being locally restricted, as is the current condition. Primary influencing factors were the specific distances protected for different stream classes and the distribution of reserves across the landscape.

VI. Cumulative Effects Assessment. No known populations occur off federal land. Numerous populations occur on the edge of the Mt. Baker Snoqualmie NF. Loss of habitat may contribute to reduced viability.

VI. Summary. The ratings reflect the limited distribution of this species. Although it was not used in the ratings, the data in Table IV-20 in the FEMAT report did not include the most recently discovered localities. A reanalysis using current data revealed that 18 of known populations occur in late-successional reserves, 7 occur in congressionally designated areas, at least 5 occur in administrative withdrawals, and 2 occur in the Matrix. The high percentage of protected populations may warrant a reevaluation of the ratings. An existing signed Conservation Strategy provides standards and guidelines for protecting this species on the Mt. Baker Snoqualmie NF.

VII. Mitigation. Mitigation could increase ratings, but this species probably will never be well-distributed throughout range.

A. Geographic Extent. Olympic and Western Washington Cascades Provinces. Documented from Mt. Baker Snoqualmie and Olympic National Forests

B. Specific Habitats. Seeps and other areas with year-round saturated soil within range of seral stages, most commonly late-successional and old-growth forests

C. Mitigation Measures.

- Avoid ground disturbance in vicinity of all populations and direct impacts to individual plants
- Avoid disturbance of site hydrology and maintain the saturated (but not inundated) soil conditions required for this species. Buffer isolated seeps that are not within the riparian reserves if *Galium kamtschaticum* is present.
- Avoid trail construction and road building in vicinity of all populations
- Implement the management plan in the Species Management Guide and Addendum
- Implement the monitoring plan described in Species Management Guide and Addendum

D. **Benefits.** Protection of habitat for *Galium kamtschaticum* may also afford protection for *Coptis asplenifolia*.

References:

Potash, L. 1992. Species Management Guide for boreal bedstraw (*Galim kamtschaticum*) with 1993 Addendum. Mt. Baker Snoqualmie National Forest, Mt. Lake Terrace, Washington.

Knowledgeable Individuals:

Laura Potash, Mt. Baker Snoqualmie National Forest, Mountlake Terrace, Washington.
Kendra Millam, North Bend Ranger District, North Bend, Washington.

I. **Species.** Round-leaved Orchid (*Habenaria orbiculata*) (Pursh) Torr.
synonym: *Platanthera orbiculata* (Pursh) Lind.

II. **FEMAT Rating.** 0-50-50-0

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation for Rating.**

A. **Natural History.** *Habenaria orbiculata* has a sporadic distribution within old-growth stands in northern Washington. This species is rare and local within Washington, but is included in the Washington Natural Heritage Program's monitor list (1994). The Mt. Baker-Snoqualmie National Forest has 46 known locations within ecoplots. The majority of sites are within the western hemlock zone. It is browsed by slugs (Henderson, pers. comm.; Correll, 1950), which may be a factor limiting its distribution at lower elevations; snow may limit at higher elevations. This species is shallow rooted and susceptible to ground disturbance.

Like all orchids, this species requires fungal infection for germination in nature (Arditti et al. 1990). High degrees of orchid/fungus specificity for temperate species have been reported (see Arditti et al. for review 1990). *Habenaria orbiculata* is reportedly pollinated by the large moth *Sphinx drupiferarum* (van der Pijl and Dodson 1966).

B. **Past Actions.** Timber harvest has reduced habitat.

C. **Species Range.** Alaska, Yukon, British Columbia to Newfoundland, south to California, Idaho; in the east, south through New England to New York, Pennsylvania, West Virginia, Maryland, and Virginia in the mountains to Carolina and Georgia; through the Lake states to Montana (Szczawinski 1959). An uncommon

species found in damp coniferous forests, balsam-spruce bogs, and on tundra in Labrador and Newfoundland (Williams and Williams 1983).

D. Non-habitat Factors. The narrow elevational band this species occupies suggests that it could be sensitive to climate change.

E. Features of the Alternative. *Habenaria orbiculata* is not a riparian species, yet it may be sensitive to riparian management if riparian habitat is protected and upland management is intensified. It was not considered to have any likelihood of being well-distributed throughout its range in any alternative, but has considerably less chance of being restricted to refugia in options 1 through 5.

VI. Cumulative Effects Assessment. The Washington Natural Heritage Program may have information on the distribution of this species on state and private lands. At present, cumulative effects are unknown.

VI. Summary. The ratings for *Habenaria orbiculata* reflect the current restriction of the species known range within the Mt. Baker-Snoqualmie National Forests, the limited amount of suitable lower elevation habitat, and the slow recolonization ability of the species.

The mylar maps generated using Heritage Program data for the FEMAT analysis did not include this species. It is unknown how many populations currently fall within the reserves. A map showing locations from the Mt. Baker-Snoqualmie National Forest ecoplots and District Botanist Daily Survey Forms would be useful in evaluating the percent of known populations within the proposed reserves.

VII. Mitigation. Mitigation could significantly improve ratings, but it is unlikely the species will ever be well-distributed throughout its range due to past management actions.

A. Geographic Extent. Western Washington lowlands, and Western Washington Cascades provinces. Documented from Mt. Baker Snoqualmie National Forests

B. Specific Habitats. Mesic to dry mossy forests with deep litter in western hemlock and lower silver fir associations

C. Mitigation Measures.

- Conduct systematic surveys to delineate species range and locate additional populations. Because this species is not included on the Regional Forester's Sensitive species list, routine inventories have not been conducted. Map species range on Mt. Baker Snoqualmie, starting with known localities from ecoplot database.
- Protect known populations until Conservation Strategy is developed to evaluate their significance and contribution to species viability
- Define habitat requirements and develop predictive model to determine high probability habitat
- Prepare Conservation Strategy which delineates extent of range in U.S. and provides specific guidelines to maintain viable populations.

D. Benefits. Mitigation for this species would also benefit *Allotropa virgata*,

Arceuthobium tsugense and *Coptis asplenifolia*, which share similar habitat.

References:

- Arditti, J., R. Ernst, T. Wing Yam, and C. Glabe. 1990. The contributions of orchid mycorrhizal fungi to seed germination: a speculative review. *Lindleyana* 5:249-255.
- Correll, D.S. 1950. Native orchids of North America north of Mexico. Chronica Botanica Co., Waltham, MA (illustration, p. 94).
- Sheviak, C.J. 1990. Biological considerations in the management of temperate terrestrial orchid habitats. In: Ecosystem Management: Rare species and significant habitats. New York State Museum Bull. 471:194-196.
- Szczawinski, A.F. 1959. The orchids of British Columbia. British Columbia Provincial Museum, Handbook No. 16. (map of distribution in B.C. on p. 52; illustration on p. 50).
- Williams, J.G. and A.E. Williams. 1983. Field guide to Orchids of North America. Universe Books, New York.

Knowledgeable Individuals:

Jan Henderson, Mt. Baker-Snoqualmie National Forest, Mountlake Terrace, Washington.

I. Species. Howell's lousewort (*Pedicularis howellii*) Gray

II. FEMAT Rating. 30-40-25-5

III. Modifications due to changes in Alternative 9. Fire management guidelines could increase ratings.

IV. Explanation for Rating.

A. Natural History. *Pedicularis howellii* does not appear to be limited to a particular habitat, plant association, or seral stage. It may require disturbance (e.g. fire, windthrow, root rot centers) to maintain population viability. This species may require nearly saturated soil for germination, but later stages are probably intolerant of poor drainage. Interspecific competition may also limit this species. Sufficient snowpack to provide soil moisture during the blooming season may be another important limiting factor.

Pedicularis howellii most common inhabits dry ridges in mixed conifer/shrub communities with 5-40% canopy closure and 30-80% shrub cover (Barker 1988). Associated overstory species typically include *Abies magnifica*, *A. concolor*, *Picea breweriana*, *Tsuga mertensiana*, *Pinus monticola*, with understory components of *Quercus sadleriana*, *Vaccinium membranaceum*, and *Ceanothus prostratus*.

Pedicularis howellii is restricted to edges or small openings where shaded part of the day at elevations between 4,200 and 6,300' (majority between 5,000 and 6,000'). It is more abundant in open forest (Kagan, pers. comm.) and often occurs in light gaps (Rolle, pers. comm.). Additional habitat information is provided in Barker (1988).

Climate within range of *Pedicularis howellii* is characterized by short, cool, dry summers and wet, cold winters; precipitation averages 80 to 120 inches, with much falling as snow. Approximately 68 percent of populations occur with aspects northeast to northwest. Substrate is variable, including ultramafic, metasedimentary, and granitic, soils commonly shallow and skeletal; surface texture nearly always loam to clay loams.

Bumblebees may be involved in pollination of *Pedicularis howellii*. Seed set and seed germination in the field are high. Seed germination is patchy, typically concentrated in the vicinity of the maternal parent plant. Longer distance dispersal may be facilitated by animals (e.g. deer, chickarees, squirrels); density of plants is often high along game trails.

B. Past Actions. This species may be declining due to lack of fire (Panel notes 6/93). Anecdotal information from Klamath NF indicates tractor site preparation eliminates this species (Nelson, pers. comm. 5/4/93). Cattle grazing, trail and road construction, and clearcutting have occurred within the range of this species (Barker 1988).

C. Species Range. Endemic to Siskiyou Mountains from Rogue River NF to Six Rivers and Klamath NF

Extensive field inventories were conducted in 1983 throughout the expected range and additional populations and suitable habitat were identified. In 1988, it was considered that 75-80 percent of the likely habitat had been inventoried. According to the Species Management Guide (Baker 1988), 72 populations have been documented, ranging in size from 2 to 20,000 individuals, with a total global population estimated at 69,000 to 83,000 plants. Approximately 60 percent of the populations known at that time had less than 500 individuals. Nineteen populations were located on potential commercial timber harvest sites (Barker 1988).

The majority of the populations occur on the Siskiyou and Klamath National Forests (20 populations, Foster 1992). Additional populations have been documented from the Rogue River and Six Rivers National Forest. Six out of 22 Oregon populations occur in Wilderness, four in the Applegate AMA, none were included in reserves in Oregon (Panel notes, 6/93). The majority of sites in California are within recently established wilderness areas (Barker 1988). Descriptions of the documented population centers and high probability habitat are discussed in the Species Management Guide.

D. Non-habitat Factors. Native mammalian grazing is often high (up to 100%); this is not atypical for long-lived perennial herbs and may not adversely affect viability.

E. Features of the Alternative. Ratings were dramatically different between option 1 and other options. Overall acreage of the reserves and their specific locations were features considered most important to the panel members. Concern was expressed regarding the potential for disproportionate timber harvest pressure on uplands, which could negatively affect this exclusively dry site species. Although population specific analysis using point localities was not conducted, during post-panel analysis, the large population centers mentioned in the Species Management Guide were checked to determine if they were located within Reserves. A number of populations exist in Congressionally Designated Wilderness and Late Successional Reserves.

VI. Cumulative Effects Assessment. The number of sites on private and state land is unknown; probably few if any are in Oregon.

VI. Summary. The ratings reflect the limited number of sites, restricted distribution, and the need for specific management prescriptions for this species.

During the post-FEMAT analysis, it was noted that the Species Management Guide (1988) indicates that this species inhabits early seral stages and may be an early colonizer of disturbed areas. This raised the question of the appropriateness of its inclusion on the FEMAT list. However, based on discussions with knowledgeable individuals, I concluded that this report may present a more favorable impression of this species than is warranted, particularly for Oregon, where this species is rarest. Others note that certain types of disturbance eliminates this species from the site. The Species Management Guide estimates of numbers of plants may actually be overestimates, since plants are often sparse and scattered. Based on this investigation, it was concluded that the inclusion of *Pedicularis howellii* was warranted.

VII. Mitigation. Mitigation could raise the ratings. While this species may benefit by prescribed fire and require partial opening of the canopy, it appears necessary to minimize ground disturbance, and particularly avoid tractor logging within populations. Considerable inventory work has been conducted, but some high probability areas remain unsurveyed. Additional studies to evaluate population trends, limiting factors, and ecology are recommended to manage for this species. Some basic life history information is lacking (e.g. growth rate, life span, seed viability, and germination requirements).

A. Geographic Extent. Province(s): Oregon and California Klamath Documented from Rogue River, Siskiyou, Six Rivers, and Klamath National Forests.

B. Specific Habitats. Edges of forest openings or in the damp shade of true fir forest or shrubs at 4,000 to 6,000' elevation.

C. Mitigation Measures

- Protect known populations; due to the scattered nature of individuals, larger areas may be required to maintain viable populations.
 - Minimize the size of openings created by harvest (individual or small group selection)
 - Avoid site preparation and timber harvest near and within known populations.
- (Note: Avoidance of all populations of this regional endemic was prescribed in the

Biological Evaluation for Drought Related Timber Salvage on the National Forests of the Klamath Province, prepared by Mike Foster, Eldorado NF, 8/14/92).

- Avoid heavy equipment along wet meadows and streamside/forest edges
- Route trail construction and major reconstruction away from plants in wilderness and other recreation areas
- Reroute road construction, if necessary, to avoid impacts to populations
- Restrict herbicide use within *Pedicularis howellii* habitat
- Conduct experimental studies to evaluate impacts of disturbance, including prescribed fire and implement methods which contribute to increased population trends and vigor.
- Reduction of grazing would benefit populations on two sites

D. **Benefits.** Sites for *Pedicularis howellii* are generally non-productive timber sites (growth rates of less than 20 cu. ft/acre/year). Mitigation could elevate ratings considerably.

References:

Barker, L. 7/ 14/ 88. *Pedicularis howellii* Species Management Guide and Delisting proposal, with Memo to Forest Supervisors of Siskiyou, Rogue River, Six Rivers, and Klamath National Forests and District Manager, Medford BLM.

Barker, Linda (no date). *Pedicularis howellii* Botanical Investigation. Report and Management Recommendations. Unpubl. Report on file, Klamath NF.

Knowledgeable Individuals:

Julie Nelson, Shasta Trinity NF, Redding, California.

Linda Barker, Klamath NF

Wayne Rolle, Rogue River NF, Medford, Oregon

Linda Mullens, Siskiyou NF, Grants Pass, Oregon

Mike Foster, Eldorado NF

Lazarus Macior, Department of Biology, Univ. of Ohio, Akron

I. **Species.** Bigelow's adder's tongue (*Scoliopus bigelovii*) Torrey

II. **FEMAT Rating.** 65-35-0-0

III. **Modifications due to changes in Alternative 9.** Shortening of the rotation length could reduce projected likelihood that this species would be well distributed under alternative 9. Because most of the area within this species' range is on state and private land, modification of the State Forestry Practices Act could affect viability of this species.

IV. **Explanation for Rating.**

A. Natural History. *Scoliopus bigelovii* is a long-lived perennial herb (Utech 1992), endemic to coastal forests of California (especially redwoods). Based on field observations, the factor which is likely to be limiting to its distribution is temperature; it is restricted to the coastal fog belt and inhabits moist shaded slopes below 1500' (Nelson, pers. comm.). It exhibits specialized pollination by fungal gnats belonging to closely related families Mycetophilidae (*Mycetophilla* sp.) and Sciaridae (*Sciara* sp., *Corynoptera* sp.) (Mesler et al. 1980). It is self-incompatible (Berg 1959, Mesler et al. 1980). Subterranean stems, elongated twisting pedicels, capsules dehiscing in the upper duff layers, and elaiosomes facilitate seed dispersal by ants (*Formica fusca*, *F. rufibaris*, *Aphaenogaster subterranea*) (Utech 1992, Berg 1959). Slugs may play a role in seed dispersal, by eating pod walls (Nelson, pers. comm. 5/1/93). *Scoliopus bigelovii* may bloom as early as December 15th (Nelson, pers. comm. 5/1/93), with the time of seed ripening coincident with the time of year ants are most active (Berg 1959). Shade and soil moisture are habitat conditions essential to maintaining viable populations.

B. Past Actions. Accelerated harvest of coastal redwood forests (much of which is privately and state owned) has reduced populations of this species and its habitat.

C. Species Range. Endemic to California. See map in Utech (1992). Utech (1992) states that the species is relatively common and is undercollected because it begins flowering in winter. However, field botanists expressed concern that although many historic localities exist, few populations, particularly on publicly owned land are extant. *Scoliopus bigelovii* occurs primarily in the old-growth in shady mesic understory slopes of the coastal Californian redwood forests from Humboldt County south to the Santa Cruz Mountains coniferous forests (Utech 1992). Common understory associates include *Polystichum munitum*, *Clintonia andrewsiana*, *Trillium ovatum*, *Dentaria integrifolia*, *Oxalis oregana*, *Viola sempervirens*, and *Trientalis latifolia*. One or two populations have been reported in Oregon in redwood old-growth fragments (matrix of alternative 9) near the California border within six miles of the coast.

D. Non-habitat Factors. Since the species is restricted to the coastal fog belt, potential climate change may be a significant factor influencing long-term viability.

E. Features of the Alternative. According to panel discussions (4/22/93) and following correspondence, this species is not present in any LSOG1 or LSOG2 blocks. Remaining populations occur in Redwood N.P., coastal state parks, and perhaps on private land. Under all options, concern was expressed that the range of this species is likely to contract. Only Option 1, with the protection of the late-successional and old-growth fragments was thought to provide sufficient protection to ensure that the species would be well-distributed throughout its range.

V. Cumulative Effects Assessment. Most of species range is on private land, with a little in state parks, and some on National Park Service and BLM land. Harvesting of redwood forests has posed viability risk: habitat acquisition or strengthening of California State Forestry Practices Act to eliminate old-growth redwood harvest or lengthen rotation significantly would be important to increase viability.

VI. Summary. This species was included for further analysis due to the differences in ratings between the first and second panels and the shortening of the rotation length in California. Strong concerns were expressed for this species during the first panel meeting. Further review of this low elevation coastal California endemic is warranted.

VII. Mitigation. Increasing rotation length in coastal California and/or site specific protection could increase ratings.

A. Geographic Extent. California Coast province includes most of the range of the species. All documented populations west of crest of Coast Range, all within 50 miles of ocean. Documented from Six Rivers and Siskiyou National Forests.

B. Specific Habitat. Low elevation redwood forest.

C. Mitigation Measures.

- Conduct more thorough investigations to evaluate the distribution of this species on federal land and nonfederal lands and determine the degree of protection necessary to maintain viability.
- Conduct systematic surveys to locate additional populations.
- Protect known populations.
- Acquire habitat through land exchanges.
- Lengthening the rotation of redwood forests within the range of the species would provide an alternative to the more intensive survey and protect strategy.

D. Benefits. Protection of *Scoliopus bigelovei* habitat would also afford protection to *Clintonia andrewsiana*.

References:

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- Messler, M.R., J.D. Ackerman, and K.L. Lu. 1980. The effectiveness of fungal gnats as pollinators. Amer. J. Bot. 67:564-567.
- Utech, F.H. 1992. Biology of *Scoliopus* (Liliaceae) I. Pytogeography and systematics. Ann. Missouri Bot. Gard. 79: 126-142. (illustr. p. 139, map p. 127).

Knowledgeable Individuals:

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-
- I. **Functional Group.** Canopy herbivores (South range)
- II. **FEMAT Rating.** 66-29-4-2
- III. **Modification due to changes in Alternative 9.** None; the changes which occurred to Alternative 9 prior to the additional species analysis would not have resulted in changes to the FEMAT ratings for these arthropods species groups.
- IV. **Explanation of Rating.** The FEMAT rating was influenced by the following factors.
- A. **Natural History.** The functional group reflects diversity of taxa which occupy forest canopies. As a group they are sensitive to a forest disturbance regime where any change in overstory species composition will be reflected in distribution of this group.
- B. **Past Action.** Past timber harvest of low elevation forests in the planning area have reduced the diversity of habitats available for this group. Also, past management practices such as fire suppression have changed tree species composition, and combined with recent drought have increased physiological stress on forests in the southern portion of the northern spotted owl range.
- C. **Species Range.** There is a high degree of endemism and species richness for this functional group in southern portion of the range of the northern spotted owl. This reflects the complex mosaic of habitats and environments (variations in plant communities, fire histories and interactions). Some species may be very restricted, while others are more broadly distributed.
- D. **Non-habitat Factors.** Global change may pose a long-term risk to this species group, as climate changes would affect the disturbance regime and distribution of plant communities. Frequent and broadscale application of insecticides has an adverse affect on this functional group.
- E. **Inadequate Information.** There is a significant lack of information on this arthropod functional group. There is a need to better understand local extinction and patch dynamics, as well as species distribution and taxonomy..
- F. **Features of the Alternative.** The primary features which provide benefits to this functional group are Late-Successional Reserves and standard and guidelines which retain patches of older forest in the matrix. However, there was concern that too little forest would be preserved in patches within the matrix, that stand-replacing fires could greatly reduce forest diversity within reserves, and that uneven-age management of the matrix may result in a forest landscape that is a continuous structure, rather than a mosaic of plant communities.

V. Cumulative Effects Assessment. Previous harvest on nonfederal lands, especially of lowland forests, has reduced the diversity of habitats available. Insecticide spraying has also impacted canopy herbivores.

VI. Summary. Ratings reflect uncertainty about future global change, as well as lack of knowledge of the distribution and habitat dynamics of this group. However, the likelihood of Outcomes C and D combined only totalled 6 percent for Alternative 9. Compared to Alternative 1, the principal difference is an increased likelihood of Outcome B (16 percent vs. 29 percent) with a corresponding decrease in the likelihood of Outcome A (84 percent vs. 66 percent).

VII. Mitigation. The review identified specific mitigations which could improve the ratings for this functional group.

A. Geographic Extent. The possible mitigations could be applied to federal lands of southwestern Oregon and south into California to the southern limits of the range of the northern spotted owl.

B. Specific Habitats. Mitigations to benefit this functional group would be intended to affect the forest canopy where they inhabit.

C. Mitigation Measures.

1) Retain diverse patches of forest canopies within the matrix. This could be accomplished with retention of intact patches rather than or in addition to dispersed single trees, or by providing for diversity with uneven-aged management techniques such as group selection.

2) Minimize the use of insecticide sprays

3) Minimize the likelihood of large-scale loss of forest canopy to wildfire. While this group evolved with fire as a disturbance factor, recent droughts and previous management practices have significantly altered the natural fire regime.

4) Additional surveys are needed, as well as research on habitat dynamics.

D. Benefits. These mitigations are likely to slightly improve the ratings for this functional group. With these possible mitigations, the likelihood of this group failing to function in the ecosystem would be even less than the original rating of 2 percent. Additional surveys and research will enable managers to more effectively provide for the needs of this important group within the context of ecosystem management. The possible mitigations would maintain and improve current levels of biodiversity and function.

- I. **Functional Group.** Coarse wood chewers (South range).
- II. **FEMAT Rating.** 65-21-10-4
- III. **Modifications due to changes in Alternative 9.** None; the changes which occurred to Alternative 9 prior to the additional species analysis would not have resulted in changes to the FEMAT ratings for this arthropod species group.
- IV. **Explanation of Rating.** The FEMAT rating was influenced by the following factors.
 - A. **Natural History.** This functional group is dependent on dead wood of downed logs and snags. Functionally, the group is very important in nutrient cycling in the ecosystem by facilitating the release of nutrients.
 - B. **Past Actions.** The past history of natural and anthropogenic disturbances in the southern region of the owl's range has fragmented the mature forested landscape, thus increasing the likelihood of the local extirpation of species of coarse woody debris (CWD) feeders specifically associated with the conditions found in mature forests. Arthropods dependent upon large CWD are especially vulnerable to reduced population levels or extinction. Knowledge of coarse woody debris chewers in the southern region is inadequate to allow even speculation on possible species extinctions that have already taken place.
 - C. **Species Range.** There is only rudimentary information available that would provide reliable information about the total range of each species in this functional group. However, in general, arthropod species in the southern part of the range of the northern spotted owl tend to have more restricted ranges because their habitat tends to be restricted as a result of moisture, topography and soil conditions effect on forest structure and distribution.
 - D. **Non-habitat Factors.** Global change may pose a long-term risk to this species group, as climate changes would affect the disturbance regime and distribution of plant communities. Frequent and broadscale application of insecticides has an adverse affect on this functional group.
 - E. **Inadequate Information.** As for all arthropod groups, there is a significant lack of information on taxonomy, distribution and habitat dynamics.
 - F. **Features of the Alternative.** Provision for retention of snags and down logs was the primary concern. Salvage guidelines for Late-Successional Reserves were generally considered to be adequate, but there was concern that guidelines for the matrix may not provide for sufficient CWD retention. Also, unnaturally intense fires may consume much of the accumulated coarse woody debris.
- IV. **Cumulative Effects Assessment.** Cumulative effects are of concern because of the gradual erosion of the populations of organisms and the genetic diversity they represent. Organisms of low vagility are especially vulnerable. Some show patchy distributions resulting from past extinction events.

Reduction in CWD on non-federal lands has impacted CWD chewing insects. Further reduction of CWD could lead to loss of functionality for the group in some areas. Such a loss would impact forest health wherever it occurs.

Federal lands will play an important role in maintaining viable populations of these critical organisms because it is unlikely that nonfederal lands will provide for optimum levels of CWD.

V. Summary. Alternative 9 differs from Alternative 1 in that it has a higher likelihood of Outcomes C and D combined (14 percent compared to 4 percent, respectively) for coarse woody debris chewers (south). The ratings reflect the greater species richness of the vegetation of the area, the naturally fragmented nature of the vegetation in that area because of climatic, topographic and historical influences and the response of such fragmented systems to both natural and anthropogenic disturbance. These factors combine to increase the risks of extirpation.

VII. Mitigation. The review determined that mitigation could further benefit these species.

A. Geographic Extent. The possible mitigations could be applied to federal lands of southwestern Oregon and south into California to the southern limits of the range of the northern spotted owl.

B. Specific Habitats. Generally applied to the landscape to maintain adequate levels of coarse woody debris throughout the landscape in both terrestrial and aquatic habitats.

C. Mitigation Measures.

1. Surveys of existing CWD in undisturbed landscapes - including species composition, distribution of age classes, size of CWD.
2. Surveys of arthropod species found in the different species of trees constituting the CWD (including freshly fallen and major age classes of logs).
3. Adjust management to assure adequate stocking of CWD that represents an approximation of natural species diversity, number and age class of logs to assure viable population of species of this functional group.
4. Study the effect of burning on the initial colonization of CWD by arthropods, and utilize those prescribed fire techniques which minimize impact on initial colonization by CWD chewing species.

V. Benefits. Our level of knowledge of the species composition and distribution of these organisms throughout the southern range of the northern spotted owl is inadequate. Suggested surveys would improve our knowledge and improve our ability to address management decisions. If implemented the mitigation is expected to maintain and enhance ecosystem biodiversity and help assure that this functional group will continue to play an important role in long-term nutrient cycling. As a result, the maintenance of adequate levels

of CWD in the ecosystem will likely improve the ratings for Alternative 9, by increasing likelihoods of Outcomes A, B, and C and greatly decreasing the likelihood of Outcome D.

I. Functional Group. Litter and Soil Dwelling Species (South Range).

II. FEMAT Rating. 60-20-15-6

III. Modifications due to changes in Alternative 9. None; the changes which occurred to Alternative 9 prior to the additional species analysis would not have resulted in changes to the FEMAT ratings for these arthropods species groups.

IV. Explanation of Rating. The FEMAT rating was influenced by the following factors.

A. Natural History. Litter and soil arthropods and their habitats differ between the southern and northern ranges. The climate variables in the south result in greater fragmentation of mesic habitats. The patchiness of the habitats, the complexity of the litter layer itself because of more diverse origins (related to the greater species richness of the vegetation, and higher fire risks), makes extirpation more likely in the south than in the northern, more mesic, environments with more uniform vegetational types.

The same problems associated with the fragmentation and patchiness of the CWD resource occur with the litter and soil resource but at even a finer scale. The textural and organic diversity found in the litter reflects the diversity of the plants overhead. The greater occurrence of broadleaf evergreen plants, with new different chemical characteristics, influence the litter/soil biota, adding to the complexity. Local extinction patterns have not been considered in any significant way.

B. Past Actions. The influence of past disturbances is highly significant. When the litter layer is burned, regardless of the source of the fire, the impact upon the organisms is extensive. Insect density may be reduced by as much as 90 per cent. Also when soil compaction or erosion occurs, often as a result of logging or road building, soil and litter organisms are impacted. Thus, management practices which have resulted in increased likelihood of intense fire, or which have already negatively impacted soil/litter organisms are important factors.

C. Species Range. Southwestern Oregon and northern California. Knowledge of this group from the southern range of the northern spotted owl is limited. The different vegetational types, with many different species, will surely result in a much different litter/soil arthropod fauna. Adequate inventories are lacking but this group is likely to be rich and diverse.

D. Non-habitat Factors. Global change may pose a long-term risk to this species group, as climate changes would affect the disturbance regime and distribution of plant communities. Frequent and broadscale application of insecticides has an adverse affect on this functional group.

E. Lack of Information. Proper inventories are sorely needed to provide adequate knowledge for management decisions. The general paucity of such knowledge reflects the lack of investigators and the difficulties in dealing with the complex taxonomic problems. The litter and soil fauna is exceptionally rich, and much additional work is needed on this important group of organisms so closely tied to nutrient cycling. Further, we need to know more about dynamics of the litter layer.

F. Features of the Alternative. Reduced soil disturbance within Late-Successional and Riparian Reserves would benefit these organisms, but lack of an understanding of logging practices and the impact of multiple-entry systems caused concern for soil organisms in the matrix. CWD guidelines for the matrix were also considered to be marginally adequate.

IV. Cumulative Effects Assessment. The potential significance of cumulative effects cannot be adequately evaluated because of the lack of knowledge for this group.

VI. Summary. The rating reflects concern for a species assemblage largely unknown, whose distribution across the landscape is also largely unknown. Further, the south range is generally more xeric in nature, resulting in more fragmented environments. This fragmentation of resources will result in a more fragmented fauna. These factors put the fauna at greater risk of extirpation than habitats which are more uniformly distributed spatially. Lack of information significantly influenced the ratings for all alternatives.

Outcomes C and D are more likely under Alternative 9 than for Alternative 1 (totals of 21 percent vs. 4 percent, respectively). These differences apparently reflect concern for the use of fire as a management tool which would reduce the coarse woody debris in the ecosystem. Panelists also were very concerned about the lack of knowledge for this group, and their ratings for alternatives which allowed significant management activities, such as Alternative 9, were conservative..

VII. Mitigation. It seems likely that mitigation efforts could benefit this group, although there is a limited knowledge base upon which to base mitigation.

A. Geographic Extent. Southwestern Oregon and California in within the southern range of the northern spotted owl.

B. Specific Habitats. Litter and soil habitat where it occurs. This will be highly diverse reflecting the diversity of the vegetation.

C. Mitigation Measures.

1. **Surveys and Research.** Essential to conduct inventories of litter/soil organisms to establish an adequate data base. These surveys should contain

notes on the nature of the litter containing the arthropods. Appropriate systematic expertise is required to extract the information needed. Presently, such systematic expertise is very limited.

Parallel studies should be conducted at managed and undisturbed sites. These studies should provide a means of monitoring the effectiveness of management efforts. Mitigation protocol should be developed to assure an adequate litter layer approximating natural conditions. So little work has been done that an adequately designed study is critical. Especially important is an improved understanding of the dynamics of the litter layer under natural disturbance regimes to serve as a model for restoration and management plans.

With an adequate information base on the litter/soil arthropods in the south range, and a well designed and executed mitigation protocol, the ratings might be improved. Present ratings were greatly influenced by inadequate information. Panelists believed that the southern habitats were more at risk because of more fragmented habitats, greater plant species richness, and more xeric conditions that result in more localized species. Therefore, they were relatively conservative in their ratings.

2. Habitat Management. Although fire is a natural process in these ecosystems, fire used as management tool may impact the litter resource differently than wildfire. Removal of litter by burning decreases arthropod populations significantly and there can be longterm effects on community structure and perhaps soil nutrient function. Slashburning may influence community structures of soil arthropods for many years after burning. Management application of fire should emulate intensity and spatial-temporal distribution typical of the natural fire regime. Minimization of extensive, unnaturally intense fires will benefit this group.

Soil compaction significantly affects soil and litter organisms. Multiple entry management could cause far greater compaction than single entry management. Thus, any management technique which would reduce compaction would benefit this group.

D. Benefits. The benefits of mitigation will be the development and maintenance of diverse soil and litter communities. Arthropods present in the litter/soil habitat will continue to carry out their critical role in nutrient cycling. Further studies will be required, however, to evaluate the effectiveness of any mitigation, as well as provide the basis for refinement of techniques.

-
- I. **Functional Group.** Understory and Forest Gap Herbivores (Southern Range)
 - II. **FEMAT Rating.** 47-45-5-4

III. Modifications due to changes in Alternative 9. None; the changes which occurred to Alternative 9 prior to the additional species analysis would not have resulted in changes to the FEMAT ratings for these arthropods species groups.

IV. Explanation for Rating. The FEMAT rating was influenced by the following factors.

A. Natural History. Broad group with some species very restricted and others widely distributed. Distribution of arthropods reflects distribution of vegetation. Species associated with forest gaps especially vulnerable to disturbance. As for other arthropod groups, species richness and diversity is greater in the southern portion of the range of the northern spotted owl.

B. Past Actions. Past natural and anthropogenic disturbances of the landscape affect future conditions. Forest harvest and subsequent replanting is likely to have produced vegetation patterns different from the natural disturbance such as fire. These differences will be likely be reflected in the associated insect fauna at all trophic levels. Lack of accurate inventory and survey information for this region makes it impossible to assess the impact of past actions.

C. Species Range. Southwestern Oregon and northern California.. Knowledge of this group is limited, but it is likely to reflect the great diversity of plant communities and environmental conditions found in these areas

D. Non-habitat Factors. Global change may pose a long-term risk to this species group, as climate changes would affect the disturbance regime and distribution of plant communities. Frequent and broadscale application of insecticides has an adverse affect on this functional group.

E. Features of the Alternative. Continued function of disturbance processes such as wind and fire will provide for these organisms within Late-Successional and Riparian Reserves. There was also concern that uneven-aged management would result in a fine-grained matrix rather than a mosaic.

F. Lack of Information. As for all arthropod groups, there is a significant lack of information on distribution, taxonomy, and habitat dynamics.

V. Cumulative Effects Assessment. Historically, it is likely that most ranges for species within this group included significant areas of non-federal lands. In most areas, these nonfederal lands have been disturbed to a far greater extent than the federal lands. Fragmentation of late-successional forests on nonfederal lands has increased the vulnerability of this group to extirpation.

VI. Summary. Likelihoods for Outcomes A and B were the principal differences between the ratings for Alternative 9 and Alternative 1 (71 percent, 23 percent and 47 percent, 45 percent, respectively). The totals for Outcomes C and D were similar, but Alternative 9 had a 4 percent likelihood of extirpation compared to 0 percent for Alternative 1. Lack of information was a significant factor.

VII. Mitigation. Mitigation could improve ratings for this group.

A. Geographic Extent. Southwestern Oregon and the California portion of the southern range of the northern spotted owl.

B. Specific habitats. All types of understory vegetation across the landscape.

C. Specific mitigation proposed. In areas where uneven-age management is practiced, harvesting with diverse but small patch sizes (group selection) should favor gap herbivores. Retention of unharvested trees in clumps, rather than or in addition to dispersed individuals, within regeneration-harvest units will provide sources for recolonization of the understory in new stands. Within reserves, allow gap formation processes to function unimpeded.

Adequate faunal surveys are essential with special attention paid to host plant association. The information base is truly minimal in this area.

D. Benefits. Enhanced population levels of species and maintenance of adequate representation of species to assure proper ecosystem function. Many of the insects will be herbivores and as such will be involved in the cycling of nutrients. There will be pollinators assuring reproduction of the plants. Others will be predators and parasites that help to control population levels of herbivores. In short, critical processes are likely to be maintained within those ecosystems with a full complement of faunal and floral representatives.

Mitigation should greatly reduce the likelihood of Outcome D, by increasing the likelihood of Outcome C. The significant differences between Alternative 1 and Alternative 9 will remain for Outcomes A and B.

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- I. **Species.** *Ancotrema voyanum*
- II. **FEMAT Rating.** 7-13-30-50
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
 - A. **Natural History.** Not applicable.
 - B. **Past Actions.** Not applicable.
 - C. **Species Range.** Not applicable.
 - D. **Non-habitat Factors.** Not applicable.
 - E. **Inadequate Information.** Not applicable.
 - F. **Features of the Alternative.** In the western portion of the species range, known locations are either within late successional reserve (LSR) or the Hayfork adaptive management area (AMA). Even within the AMA, the locations are within Tier 1 key watersheds. In the eastern portion of the range, locations are primarily in LSR except for a single location in French Gulch. There is uncertainty about the fate of locations in the AMA since riparian reserve standards may be modified in AMAs.
- V. **Cumulative Effects Assessment.** A small portion of the range is on checkerboard ownership. Any negative cumulative effect is adequately reflected in the original rating.
- VI. **Summary.** Detailed examination of maps suggests that protection for *Ancotrema* is stronger than was reflected in original ratings. The majority of known locations are within LSR or tier 1 key watershed. Riparian reserves should provide for additional, currently unknown locations outside of LSRs. However, locations in AMAs may not receive the same level of protection.
- VII. **Mitigation.** Additional mitigation could be provided for locations in the AMA where riparian measures might differ from the standard riparian reserve stipulations.
 - A. **Geographic Extent.** Hayfork AMA and surrounding lands
 - B. **Specific Habitats.** Terrestrial habitats along permanent streams and small headwaters
 - C. **Mitigation Measures.** 1) Ensure that the riparian reserves are properly implemented to include small headwaters. 2) Apply riparian reserve standards within the Hayfork AMA equivalent to those applied in other riparian reserves. 3) Fence out cattle on small headwater streams where the species is known or expected to occur. 4) Conduct inventories within the known and expected species range to

determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective. Consultation with a mollusc taxonomist is needed to guard against confusion with similar-appearing species such as *Haplotrema keepi*. The first priority for surveys should be the Hayfork AMA north of the town of Hayfork.

D. Benefits. 1) Proper implementation of the riparian reserves should provide for substantial protection of both known and newly discovered sites. As noted above, this will provide more benefit than was reflected in the initial rating. 2) Strengthening riparian reserve standards in the Hayfork AMA will provide protection for known sites and eliminate the uncertainty associated with current AMA direction. In combination with other riparian reserves, this will provide substantial protection to all known species locations. 3) Cattle grazing could have severe impacts on the species in small headwaters, so protection of those headwaters would substantially increase protection for the species. 4) Inventory would provide a much higher level of certainty that appropriate sites are actually being protected for the species, and would allow specificity for other measures such as protection from grazing.

I. Species. *Cryptomastix devia*

II. FEMAT Rating. 0-7-50-43

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Species distribution has declined due to forest management and urban area development.

C. Species Range. Species was historically widely-distributed, and may have been quite common within its range. It currently ranges from southern Vancouver Island to the Columbia Gorge, and is rare.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Some of the remaining species locations fall on the Olympic and Gifford Pinchot National Forests, and may fall within the AMAs on those forests. There is uncertainty about the protection that would be afforded within AMAs since riparian reserve standards may be modified within them. Species experts expect that there are other locations of the species on federal land, and that some of these may basically be in matrix lands. Such locations would be provided some

protection by riparian reserves since the species has a riparian association. Some sites could, however, occur outside the riparian reserves.

V. **Cumulative Effects Assessment.** Ft. Lewis is an extremely important area for the species. However, the rating given to the species for Alternative 9 was already based on the assumption that no protection would be provided for the species on Ft. Lewis.

VI. **Summary.** This species is difficult to rate since few locations are known, but the species is thought to still be widely-distributed. However, it seems that the species will receive substantial protection from the riparian reserves where it does occur on federal land. Species occurrence within AMAs complicates the assessment, and it could be prudent to strengthen the application of riparian reserve standards in the AMAs.

VII. **Mitigation.** Mitigation is possible

A. **Geographic Extent.** Mitigation should be applied within the species range which basically encompasses the Puget Trough, extending up the Columbia River to Carson, WA.

B. **Specific Habitats.** Permanent streams; springs and seeps; moist shaded ravines. Generally found in areas that have some deciduous component.

C. **Mitigation Measures.** 1) Ensure that the riparian reserves are properly implemented and include springs and seeps. 2) Ensure that riparian reserve standards applied within the Olympic and Cispus AMAs are consistent with those applied elsewhere. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective. Apply additional mitigation on a site-specific basis where appropriate.

D. **Benefits.** 1) Proper implementation of the riparian reserves should provide for substantial protection of newly discovered sites. 2) Strengthening of riparian reserve standards in the Olympic and Cispus AMAs will eliminate the uncertainty associated with current AMA direction. 3) Inventory would provide a much higher level of certainty that appropriate sites are actually being protected for the species, and would provide the basis for other site-specific measures. These measures in sum would substantially decrease the likelihood of extirpation of the species from federal lands covered by this decision, and would increase the likelihood of maintaining the species well-distributed, or well-distributed with gaps, within its range. However, additional attention would still be needed for species locations on Ft. Lewis and on non-federal lands.

I. **Species.** *Cryptomastix hendersoni*

II. **FEMAT Rating.** 27-22-25-27

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Habitat is on talus and in springs and seeps, and is subject to disturbance from roads, railroads, and quarrying operations.

B. Past Actions. Habitat has been severely modified on Gifford Pinchot. Restoration and recolonization in near future are not likely for areas where the species has been locally extirpated.

C. Species Range. Species is reasonably broadly distributed through the Columbia Gorge, but its distribution may have been truncated somewhat on the east end of the gorge.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Known locations on federal land all occur within LSR under Alternative 9.

V. Cumulative Effects Assessment. Cumulative effects are important as the distribution of the species includes a mix of federal and nonfederal sites within the Columbia Gorge. However, possible negative cumulative effects on nonfederal lands would not substantially affect the persistence of the species on federal lands.

VI. Summary. The rating given for the species under Alternative 9 largely reflects uncertainty about management of LSRs under the alternative, and also reflects concerns about cumulative effects.

VII. Mitigation. Mitigation is possible

A. Geographic Extent. Mitigation should be applied within the species range in the Columbia Gorge

B. Specific Habitats. Habitat to be protected is rock talus, springs and seeps. The talus areas are generally forested. The species does not have a strong riparian association.

C. Mitigation Measures. Mitigation for the species is appropriate even within LSRs since thinning and other operations could disrupt local populations if not done carefully. The first level of mitigation would be protection of the currently known sites. Buffers as small as 10 acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys for the species are quite easy. Roughly 50 percent of all possible sites have already been surveyed. Small buffers would also be appropriate for the species when found outside LSRs.

D. Benefits. Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands, possibly approaching the 80 percent of combined outcomes A and B projected under Alternative 1.

I. Species. *Helminthoglypta hertleini*

II. FEMAT Rating. 32-27-30-12

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Not applicable.

C. Species Range. The species range is in south central Oregon and north central California. None of the currently known species locations are on federal lands. However, species experts think that some portion of the species range is on federal land.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. The species habitat is in talus, so the species is partially riparian associated, but further information is needed to test the strength of the association. As a result, it is difficult to judge how well riparian reserves would provide for the species.

F. Features of the Alternative. With no locations on federal lands, it is difficult to say how the alternative influences the species.

V. Cumulative Effects Assessment. Cumulative effects are clearly important since all known locations are on nonfederal land. The apparent degree of dependence on nonfederal land is not reflected in the current rating.

VI. Summary. The rating for this species is based on very little information, and no known locations on federal land. However, species experts expect that some significant portion of the species range may be on federal land, and there is uncertainty about how well the riparian reserves will provide for the species. These uncertainties were reflected in the likelihood assigned to species extirpation from federal land.

VII. Mitigation. Mitigation is possible

A. Geographic Extent. Mitigation should be applied within the species range in

south central Oregon and north central California.

B. Specific Habitats. Habitat to be protected is rock talus. Some of the species sites may be in riparian reserves, but the species does not have a strong riparian association.

C. Mitigation Measures. Mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. However, the surveys are quite labor intensive since they must be conducted in talus. When sites are located, they may be protected within riparian reserves, or may require additional protection. As with other species, reserves on the order of tens of acres would probably be effective in providing for the species.

D. Benefits. Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' newly-discovered sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. Species. *Helminthoglypta talmadgei*

II. FEMAT Rating. 27-40-27-7

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The species is generally associated with rock talus (probably limestone), so could be disturbed by road construction, and may also be disturbed by removal of forest cover.

B. Past Actions. Not applicable.

C. Species Range. Species has a restricted distribution and is known from only a handful of sites.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Species full range is not well known, especially on the west and south.

F. Features of the Alternative. Under Alternative 9, the known locations of the species are located roughly as follows: 6 in LSR, 2 in matrix (or possibly on private), 7 in AMAs, and 1 on the Hoopa Reservation. All sites outside the LSRs are subject to possible disturbance, and even the sites in LSRs could be disturbed by thinning or other management activities.

V. **Cumulative Effects Assessment.** One site is on tribal land and 2 are possibly on private land. Other currently unknown sites are likely on private and tribal lands. Management of these sites is a concern, but would probably not influence persistence of the species on federal lands as long as those lands are managed appropriately.

VI. **Summary.** Detailed examination of the Alternative 9 map reveals that many of the species' known locations are subject to disturbance, which could result in species extirpation from some substantial portion of its range. The actual situation for the species could in fact be poorer than is reflected in the initial rating.

VII. **Mitigation.** Mitigation measures are possible.

A. **Geographic Extent.** Species range is fairly restricted occurring around the Hayfork AMA and Hoopa Reservation.

B. **Specific Habitats.** Habitat to be protected is rock talus, probably often associated with limestone formations. Some of the species sites may be in riparian reserves, but the species does not have a strong riparian association.

C. **Mitigation Measures.** The first level of mitigation would be protection of the currently known sites. Buffers as small as 10 acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. They can be done in association with surveys for *Ancotrema voyanum*. Specific protection must also be provided within LSRs since proposed management in the LSRs could impact the species.

D. **Benefits.** Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. **Species.** *Megomphix californicus*

II. **FEMAT Rating.** 17-30-30-23

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Only 9 localities are currently known for the species, so elimination of any local population is considered significant.

B. **Past Actions.** Not applicable.

C. **Species Range.** Species range is already characterized by gaps in distribution. The

range includes 8 localities in the Klamath Mountains and one in Napa County, California.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. It is not known if the large apparent gap between the localities in the Klamath Mountains and the locality in Napa County is real or reflects absence of investigation in the inner North Coast Ranges.

F. Features of the Alternative. The species' known locations are distributed roughly as follows: 2 in LSRs, 3 on private land, 2 in the Hayfork AMA, 1 split between AMA and private, and 1 split between matrix and private.

V. Cumulative Effects Assessment. Five of the nine known locations are on nonfederal land, and management for those sites is unknown. This probably contributed to the likelihood for extirpation in the original rating.

VI. Summary. The species' habitat is along permanent streams, and should receive significant protection in the riparian reserves. Protection of sites in the Hayfork AMA is uncertain since riparian standards could be modified within the AMA.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Klamath Mountains and Napa County

B. Specific Habitats. Riparian areas along permanent streams

C. Mitigation Measures. 1) Ensure that the riparian reserves are properly implemented. 2) Ensure that riparian reserve standards applied within the Hayfork AMA are consistent with those applied elsewhere. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist.

D. Benefits. 1) Riparian reserves should be effective in protecting a large portion of the species sites. 2) Strengthening of riparian reserve standards in AMAs would increase the certainty of protection for species sites located in the AMA. 3) Inventories would provide a much higher level of certainty that appropriate sites for the species are actually receiving adequate protection.

I. Species. *Megomphix hemphilli*

II. FEMAT Rating. 13-33-37-17

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Has been extirpated from most historic sites, and is rare on its remaining sites. Existing federal sites are restricted to the Mount Baker-Snoqualmie and the Olympic Peninsula.

C. Species Range. The species is currently thought to be restricted to the Olympic National Forest and Park and Mt. Baker-Snoqualmie National Forest.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Reserves on Mt. Baker Snoqualmie miss the 3 historic sites. Riparian reserves may provide substantial protection for the species.

V. Cumulative Effects Assessment. Most of the historic species locations were on private land. Extent of current species' range on nonfederal land is unknown.

VI. Summary. The rating is based on lack of knowledge about the species current range, and incomplete understanding of its ecology. Riparian reserves may provide substantial protection, but possible modification of reserve standards in the Olympic AMA leave uncertainty about protection of species in that area.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Mitigation would be restricted to the species range on Olympic Peninsula and Mt. Baker-Snoqualmie

B. Specific Habitats. Mitigation should be applied within riparian habitats, and possible in upland areas of old forest

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist. 3) Ensure that riparian reserve standards applied in the Olympic AMA are consistent with those applied elsewhere.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. Strengthening the riparian reserve direction for the Olympic AMA would provide greater likelihood of species protection in that area.

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- I. **Species.** *Monadenia callipeplus*
- II. **FEMAT Rating.** 20-22-25-33
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. **Natural History.** Species is rare and endemic, which contributes to rating (however, it does fare better under some alternatives than under others)
 - B. **Past Actions.** Not applicable.
 - C. **Species Range.** Not applicable.
 - D. **Non-habitat Factors.** Not applicable.
 - E. **Inadequate Information.** Not applicable.
 - F. **Features of the Alternative.** Both known species locations are outside of LSRs under Alternative 9, but should receive significant protection from riparian reserves.
- V. **Cumulative Effects Assessment.** There are no know locations on nonfederal lands, but the species range is expected to extend off of federal lands. This should not significantly affect the ability to sustain the species on federal land, and probably did not play a role in the initial rating.
- VI. **Summary.** The initial rating was based on the rare and endemic distribution of the species and the fact that its locations fell in matrix lands. However, better understanding of the role of riparian reserves would probably be reflected in more positive ratings.
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.** Mitigation would be applied within the species range around the Scott River.
 - B. **Specific Habitats.** The species is primarily riparian associated.
 - C. **Mitigation Measures.** The first level of mitigation is to insure that riparian reserve standards are properly implemented. The second level would be to survey for the species in riparian areas within its range. Visual surveys are possible, but identification is difficult and should be done through consultation with a mollusc taxonomist.
 - D. **Benefits.** Riparian reserves should be effective in providing protection for the species' populations, and surveys would help insure that appropriate sites for the species are being protected.

I. **Species.** *Monadenia chaceana*

II. **FEMAT Rating.** 23-37-27-13

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. Natural History. The species occurs in shrubby areas and rockslides, both along riparian zones. These habitats are probably protected by the riparian reserves of Alternative 9, but this is less certain than is the case with more classically riparian species.

B. Past Actions. Not applicable.

C. Species Range. The species range is restricted to a relatively small area around the Shasta and Little Shasta Rivers. Most of the known sites are on nonfederal land.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Of 7 known species locations, 6 are on nonfederal land. The only federal location is either matrix or administrative withdrawal under Alternative 9. Riparian reserves provide some protection for the species, but there could be species locations outside of the reserves.

V. **Cumulative Effects Assessment.** Cumulative effects are very important with this species since most of the known locations are on nonfederal land, and species experts expect that the currently unknown portion of the species range lies east of federal land in the Yreka/Holbrook Valley. The current rating is based largely on federal land, so a rating that included the effects of other lands would likely project a higher risk level.

VI. **Summary.** Only a small portion of the species range is thought to occur on federal land. Riparian reserves provide some protection, but some species locations could occur outside the reserves.

VII. **Mitigation.** Mitigation is possible.

A. Geographic Extent. Mitigation would be restricted to the species range in the locale of the Shasta and Little Shasta Rivers.

B. Specific Habitats. Mitigation should be applied within riparian habitats, including shrub areas and rockslides that occur in or near the riparian zones.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Ensure that known sites are

protected within the riparian reserves or in additional reserves added to the riparian areas. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective.

D. Benefits. Proper implementation of the riparian reserves should provide some protection to the species. However, since some of the species locations may be on the edge of riparian reserves, those locations could be further protected with additional small reserves (probably tens of acres). Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. These mitigation would substantially increase the likelihood that the species would remain well-distributed within its range on federal land, but could only partially compensate for the larger cumulative effects concerns.

I. Species. *Monadenia churchi*

II. FEMAT Rating. 40-33-13-13

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The species is split into distinct eastern and western populations. The western portion of the range is in the area around the Hayfork AMA and the population in that portion of the range is associated both with limestone outcrops in upland sites and with varied rock types in riparian corridors. The eastern portion of the range is in the area of Shasta Lake, where the population is largely riparian associated. This distinction between the two populations makes it difficult to determine the effects of particular actions on the species as a whole.

B. Past Actions. Not applicable.

C. Species Range. Not applicable.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Taxonomy of the species could use clarification. The eastern and western populations may in fact represent distinct species. However, the clarification is unlikely to affect management considerations.

F. Features of the Alternative. Under Alternative 9, the known species locations are distributed roughly as follows: 4 in the Hayfork AMA, 5 in LSR or wilderness, 1 in a combination of AMA and wilderness, 1 in a combination of AMA and private, 7 in matrix, and 2 in a combination of private and matrix.

V. **Cumulative Effects Assessment.** A small portion of the species' range and locations is located on non-federal land, but probably does not have a significant effect on the ability to sustain the species on federal land.

VI. **Summary.** The rating reflects the rare nature of the species, and the potential for disturbance of the species' locations in AMA and matrix. There is some potential for extirpation of the species from portions of the western part of its range where it is associated with limestone outcrops and other hillsides which are not necessarily covered by protection measures.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Mitigation could be applied both in the eastern part of the species range around Shasta Lake and in the western portion of the range in and around the Hayfork AMA.

B. **Specific Habitats.** Mitigation in the eastern part of the range would involve riparian protection, and in the western part it would include limestone outcrops.

C. **Mitigation Measures.** The following mitigation would be applied within the eastern part of the range. 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist.

In the western part of the range, the first level of mitigation would be protection of the currently known sites. Buffers as small as tens of acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. Surveys should focus on limestone outcrops, as roadbuilding has the greatest potential for disturbing species locations. Focus should, therefore, be on surveys done during the analysis of proposed new roads or road maintenance projects.

D. **Benefits.** Proper implementation of riparian reserves in the eastern part of the range would provide very significant benefit to the species. Completion of surveys would provide greater knowledge of the level of protection being provided. In the western portion of the range, protection of known and newly discovered sites would provide substantial protection against the possibility of species extirpation from federal land.

I. **Species.** *Monadenia fidelis celeuthia*

II. **FEMAT Rating.** 33-33-23-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Not applicable.

C. Species Range. The known species range is restricted to a small area adjacent to the Rogue River. There are currently only 3 known locations.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Two of the known sites are on nonfederal land. Under Alternative 9, the third site may be in an LSR (this needs to be checked on a detailed map). The species is strongly riparian associated, so riparian reserves should provide substantial protection.

V. Cumulative Effects Assessment. Cumulative effects are a concern, as 2 of the 3 known sites are located on nonfederal lands. However, the species range is likely much larger than currently known, so it is difficult to determine the overall balance between federal and nonfederal effects. The current rating is probably independent of the cumulative effects concern.

VI. Summary. The strong riparian association of the species indicates that it will be substantially protected by the riparian reserves. Rarity and lack of information contribute to the species rating under Alternative 9. However, it was rated more positively under more protective alternatives since such alternatives provide greater assurance in the face of uncertainty. The current species rating is probably somewhat conservative, but could be improved by simple measures.

VII. Mitigation. The rating for the species can be improved with mitigation.

A. Geographic Extent. Mitigation would be restricted to the species range in the vicinity of the Rogue River

B. Specific Habitats. Mitigation should be applied within riparian habitats.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective. However, for this and other subspecies of *Monadenia fidelis*, the survey process should include consultation with a mollusc taxonomist to develop field characters for recognition of the subspecies. Where diagnostic characteristics grade, over a distance of miles, into the characters of an adjacent subspecies, practical working definitions of

the subspecies limits will have to be devised.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. These measures would reduce or virtually eliminate the risk of species extirpation from federal land as a result of the proposed action. They would also increase the likelihood that the species would remain well-distributed within its range on federal land.

I. Species. *Monadenia fidelis flava*

II. FEMAT Rating. 27-37-30-7

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Not applicable.

C. Species Range. The species is found only in southwest Oregon in Curry County, and has been located in only a handful of sites. Most of the range is on nonfederal land.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Of 11 known locations, 9 are located on private land and one on state land. The only site on federal land occurs in both an LSR and tier 1 key watershed under Alternative 9.

V. Cumulative Effects Assessment. Cumulative effects are a critical concern since most of the known sites are off federal land, and species experts expect that unknown portions of the range are also off federal land. The potential risks to the species due to cumulative effects are probably stronger than reflected in the current rating.

VI. Summary. The species is strongly riparian associated, so the portion of its range on federal land is substantially protected through a combination of riparian reserve, LSR, and tier 1 key watershed. The rating for the species, based solely on federal management, should probably be similar under this alternative and the most protective alternatives.

VII. Mitigation. Mitigation is possible to provide a greater level of assurance about the

species protection.

A. Geographic Extent. Mitigation would be restricted to the species range in southwestern Oregon

B. Specific Habitats. Mitigation should be applied within riparian habitats.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. The combination of these actions should virtually eliminate the risk of species extirpation from federal land due to the proposed action, and should increase the likelihood of the species remaining well-distributed within its range.

I. Species. *Monadenia fidelis klamathica*

II. FEMAT Rating. 23-27-33-17

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Not applicable.

C. Species Range. It is known from only one location, in the Klamath National Forest.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Under Alternative 9, the one known location occurs in a mix of matrix and possibly administrative withdrawal.

V. Cumulative Effects Assessment. No locations are known to be on private land, so cumulative effects are not a strong concern.

VI. Summary. The rarity of the species clearly influenced its rating. Even though

specific locations are not known, it was assumed that alternatives with more reserves would protect the species better than alternatives with fewer reserves. However, the species has a strong riparian association, and the riparian reserves are likely to provide substantial protection. Thus, the risk of extirpation that was projected in the initial ratings is based on the extreme rarity of the species, not necessarily on the features of Alternative 9.

VII. Mitigation. Additional mitigation is possible.

A. Geographic Extent. Mitigation would be applied within the species range in Siskiyou County, California

B. Specific Habitats. Riparian

C. Mitigation Measures. Mitigation would involve surveying for the species in order to determine the adequacy of the riparian reserves, and consideration of additional mitigation on a site-specific basis if appropriate. These might involve measures such as the restriction of grazing.

D. Benefits. Additional surveys, and the application of site-specific mitigation, should essentially eliminate the likelihood that the species will be extirpated from federal land as a result of the proposed action, and increase the likelihood that the species would remain well-distributed within its range.

I. Species. *Monadenia fidelis leonina*

II. FEMAT Rating. 27-33-30-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Not applicable.

C. Species Range. Currently known in only two locations north of the Klamath River.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Under Alternative 9, one of the known locations is in matrix land within an area of checkerboard ownership. The other is on nonfederal land.

V. Cumulative Effects Assessment. Species occurs in checkerboard ownership area, and it

appears that cumulative effects were already considered in developing the rating for FEMAT.

VI. Summary. The rarity of the species influenced its rating and created enough uncertainty that some risk of extirpation was predicted for all alternatives. However, the species is strongly riparian associated, so riparian reserves should provide substantial protection for both currently known and future-discovered sites.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Mitigation would be applied within the species known range in the area north of the Klamath River. Species may also range south of the river. Further surveys are needed to determine the full extent of its range.

B. Specific Habitats. Riparian

C. Mitigation Measures. Mitigation would involve surveying for the species in order to determine the adequacy of the riparian reserves, and consideration of additional mitigation on a site-specific basis if appropriate. These might involve measures such as the restriction of grazing if sites are found to be within grazing allotments. Visual surveys are adequate for the species.

D. Benefits. Additional surveys would substantially improve our understanding of the species range and the level of protection afforded by the riparian reserves. The application of site-specific mitigation should essentially eliminate the likelihood that the species will be extirpated from federal land as a result of the proposed action, and increase the likelihood that the species would remain well-distributed within its range.

I. Species. *Monadenia fidelis minor*

II. FEMAT Rating. 43-35-22-0

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species occurs in springs, seeps and talus slopes. The talus sites could be disturbed by activities associated with roadbuilding and maintenance. Species is currently very rare.

B. Past Actions. The use of talus in dam building in the Columbia Gorge probably significantly reduced the number of local populations of the species.

C. Species Range. The species range is restricted to the Columbia Gorge, and a significant part of the range falls outside the range of the Northern Spotted Owl.

D. **Non-habitat Factors.** Not applicable.

E. **Inadequate Information.** Not applicable.

F. **Features of the Alternative.** Species occurs in reserves in all alternatives (including 9) but there was concern about the possible effects of management within the reserves.

V. **Cumulative Effects Assessment.** A significant part of the species range falls on nonfederal land within the Columbia River Gorge National Scenic Area. Disturbance of the species on these lands could have a significant impact.

VI. **Summary.** The rating for the species reflects its local distribution and rarity, and the judgement that activities in LSRs could have negative impacts on some local populations.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Mitigation should be applied within the species range in the Columbia Gorge

B. **Specific Habitats.** Habitat to be protected is rock talus.

C. **Mitigation Measures.** The first level of mitigation would be protection of the currently known sites. Buffers as small as 10 acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. Specific protection must also be provided within LSRs since proposed management in the LSRs could impact the species.

D. **Benefits.** Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. **Species.** *Monadenia fidelis ochromphalus*

II. **FEMAT Rating.** 40-30-20-10

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Not applicable.

B. **Past Actions.** Not applicable.

C. **Species Range.** The species is known from only 3 locations in Siskiyou County,

California.

D. **Non-habitat Factors.** Not applicable.

E. **Inadequate Information.** Not applicable.

F. **Features of the Alternative.** Under Alternative 9, the one species location on federal land is in an LSR. The other 2 locations are on nonfederal lands.

V. **Cumulative Effects Assessment.** Cumulative effects are a concern since 2 of the 3 known locations are on nonfederal land. The initial rating appears to have been independent of cumulative effects, so the actual projection for the species as a whole may be more pessimistic. However, it is suspected that the species ranges further onto federal land, which would moderate the cumulative effects concern. Obviously, more information is needed.

VI. **Summary.** The one species location is in LSR, and the species is strongly riparian associated so should find additional protection in the riparian reserves. In addition, it is suspected that the currently unknown portions of the species range fall within either LSR or the Marble Mountain Wilderness. Thus, it appears that the species has substantial protection under the proposed action, and that the initial rating may have been somewhat conservative.

VII. **Mitigation.** Mitigation actions are possible.

A. **Geographic Extent.** Mitigation would be applied within the species range in an area adjacent to the Marble Mountain Wilderness.

B. **Specific Habitats.** Riparian

C. **Mitigation Measures.** Mitigation would involve surveying for the species in order to determine the adequacy of the riparian reserves, and consideration of additional mitigation on a site-specific basis if appropriate. These might involve measures such as the restriction of grazing. Visual surveys are adequate for the species, and it is readily field-recognizable. Surveys should include verification of currently known sites as the existing locality descriptions are unclear.

D. **Benefits.** Additional surveys would substantially improve our understanding of the species range and the level of protection afforded by the riparian reserves. The application of site-specific mitigation should essentially eliminate the likelihood that the species will be extirpated from federal land as a result of the proposed action, and increase the likelihood that the species would remain well-distributed within its range.

I. **Species.** *Monadenia fidelis salmonensis*

II. **FEMAT Rating.** 47-30-23-0

III. **Modifications due to changes in Alternative 9.**

IV. Explanation of Rating.

A. Natural History. Not applicable.

B. Past Actions. Not applicable.

C. Species Range. The species is known from only a handful of sites in Siskiyou County, California.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. An objective definition for recognition of this subspecies is lacking, and there is some question about whether it represents a valid subspecies. See comments under *Monadenia fidelis celeuthis* regarding characters for field recognition.

F. Features of the Alternative. Under Alternative 9, two of the species sites are a mixture of matrix and administrative withdrawal, one is matrix, and one is probably in an LSR. In addition, riparian reserves should provide substantial protection for this strongly riparian species.

V. Cumulative Effects Assessment. No locations are known to be on private land, so cumulative effects are not a strong concern.

VI. Summary. There was low likelihood projected that the species would be extirpated from federal land, largely on the strength of the riparian reserves. However, even under the most protective alternatives (i.e., Alternative 1), there is some likelihood that the species will be restricted to refugia due to the localized nature of its distribution.

VII. Mitigation. Additional mitigation is possible.

A. Geographic Extent. Mitigation would be applied within the species range in Siskiyou County, California

B. Specific Habitats. Riparian

C. Mitigation Measures. Mitigation would involve surveying for the species in order to determine the adequacy of the riparian reserves, and consideration of additional mitigation on a site-specific basis if appropriate. These might involve measures such as the restriction of grazing if sites are found to be within grazing allotments.

D. Benefits. Additional surveys, and the application of site-specific mitigation, could substantially increase the likelihood that the species would remain well-distributed within its range.

I. Species. *Monadenia scottiana*

II. **FEMAT Rating.** 42-23-25-10

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Not applicable.

B. **Past Actions.** Not applicable.

C. **Species Range.** Species is known from only 5 sites around the Scott River and its tributaries in California.

D. **Non-habitat Factors.** Not applicable.

E. **Inadequate Information.** Not applicable.

F. **Features of the Alternative.** Under Alternative 9, the 5 known sites are distributed roughly as follows: 3 in matrix lands, one on a combination of matrix and administrative withdrawal, and one on private.

V. **Cumulative Effects Assessment.** The sites on private land contributed to the likelihood of extirpation. However, the fate of that site and other currently unknown sites on nonfederal land should not reduce the ability of sites on federal lands to persist.

VI. **Summary.** *M. scottiana* is a fairly strong riparian associate, so the riparian reserves should provide substantial protection for sites on federal land. However, even under the most protective alternatives (i.e., Alternative 1), there is some likelihood of the species being restricted to refugia, or of extirpation. This results from the rare and localized nature of the species distribution, and the portion of the species range on nonfederal land.

VII. **Mitigation.** Measures are possible to improve understanding of the species likely fate under the proposed action.

A. **Geographic Extent.** Mitigation would be restricted to the species range around the Scott River and its tributaries in California.

B. **Specific Habitats.** Mitigation should be applied within riparian habitats.

C. **Mitigation Measures.** The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist.

D. **Benefits.** Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a

site specific basis if they are needed. However, there would still be some likelihood of the species being restricted to refugia, or of extirpation. This results from the rare and localized nature of the species distribution, and the portion of the species range on nonfederal land.

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- I. **Species.** *Monadenia setosa*
 - II. **FEMAT Rating.** 30-28-28-13
 - III. **Modifications due to changes in Alternative 9.**
 - IV. **Explanation of Rating.**
 - A. **Natural History.** Not applicable.
 - B. **Past Actions.** Not applicable.
 - C. **Species Range.** The species has a restricted range surrounding the Trinity River in California, and it is currently known from only 9 locations.
 - D. **Non-habitat Factors.** Not applicable.
 - E. **Inadequate Information.** Not applicable.
 - F. **Features of the Alternative.** Under Alternative 9, the species known locations are distributed roughly as follows: 4 in LSRs; 3 in AMAs; 1 site mixed between LSR and private land; and 1 site on private land.
 - V. **Cumulative Effects Assessment.** About 20 percent of the known species locations are on private land. This figure could probably be extrapolated to the whole species range. Loss of these sites would be significant, but would probably not influence the ability to sustain the species on federal lands.
 - VI. **Summary.** The species is a riparian associate, and riparian reserves will provide significant protection to species locations. The location of 3 known sites in the Hayfork AMA contributes to uncertainty since standards for riparian management could be modified within AMAs. The species is federally listed as category 2, and listed in California as threatened.
 - VII. **Mitigation.** Some mitigation is possible.
 - A. **Geographic Extent.** Area around Trinity River, including the Hayfork AMA
 - B. **Specific Habitats.** Riparian areas along permanent streams
 - C. **Mitigation Measures.** 1) Ensure that the riparian reserves are properly implemented. 2) Ensure that riparian reserve standards applied within the Hayfork

AMA are consistent with those applied elsewhere. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective.

D. Benefits. 1) Riparian reserves should be effective in protecting a large portion of the species sites. 2) Strengthening the application of riparian reserve standards in AMAs would increase the certainty of protection for species sites located in the AMA. 3) Inventories would provide a much higher level of certainty that appropriate sites for the species are actually receiving adequate protection.

I. Species. *Monadenia troglodytes troglodytes*

II. FEMAT Rating. 33-37-17-13

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The species habitat is generally shrub covered or lightly forested limestone talus. Thus, it does not benefit from riparian protection.

B. Past Actions. Not applicable.

C. Species Range. The species range is small, restricted to the area around the McCloud River arm of Shasta Lake. The species is known from only a handful of sites within the range.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Under Alternative 9, most of the species known locations are located on matrix lands.

V. Cumulative Effects Assessment. Known species locations are largely on federal land.

VI. Summary. The species does not receive protection from riparian reserves, and its known sites are not located within LSRs in Alternative 9. Thus, there is a real likelihood that the species could be extirpated from a number of its sites. The most likely disturbance is road building across the limestone talus where the species is located. Species is a federal Category 2 candidate.

VII. Mitigation. Mitigation is possible, but may be difficult.

A. Geographic Extent. Mitigation would be applied within the species range along the McCloud River arm of Shasta Lake.

B. Specific Habitats. Limestone outcrops

C. Mitigation Measures. The first level of mitigation would be protection of the known species locations. Reserves of tens of acres could be effective in providing for these sites. The second level would be surveys of the suspected species range to determine the locations of additional species sites. These would be protected in turn. Surveys prior to road building, or substantial road maintenance, would be particularly important.

D. Benefits. Protection of known sites would reduce the likelihood of species extirpation from federal land. Additional surveys and protection, especially prior to road building, would virtually eliminate the risk of species extirpation from federal land. However, because of the nature of the species distribution, there would still be likelihood that it would be restricted to refugia.

I. Species. *Monadenia troglodytes wintu*

II. FEMAT Rating. 33-37-17-13

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The species habitat is limestone outcrops, so it may be impacted by road-building, and it does not benefit from riparian reserves.

B. Past Actions. Not applicable.

C. Species Range. The species has a restricted range along the Pit River arm of Shasta Lake, and is known from only a handful of locations within the range.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Most of the species locations on federal land fall within administrative withdrawals.

V. Cumulative Effects Assessment. The species range contains significant checkerboard ownership, so there are likely a number of species locations on nonfederal land. The fate of these locations should not significantly reduce the ability to sustain the species on federal land.

VI. Summary. Species locations within administrative withdrawals should receive some substantial protection. This was not clear at the time of the initial ratings, and the prognosis for the species would probably be better than the initial rating if the administrative withdrawals are kept in place. The species is a federal Category 2 candidate.

VII. Mitigation. Mitigation measures are possible.

A. Geographic Extent. Mitigation should be applied along the Pit River arm of Shasta Lake

B. Specific Habitats. Mitigation would be applied within the species habitat composed of limestone outcrops

C. Mitigation Measures. The first level of mitigation would be to insure that the administrative withdrawals within the species range are not changed to a less restrictive allocation. The second level of mitigation would be the establishment of specific protection for the known species locations. Reserves of tens of acres could be effective. The third level of mitigation would be surveys for the species, and protection for newly discovered sites. Surveys and protection would be particularly important prior to road building or reconstruction.

D. Benefits. Maintenance of administrative withdrawals would reduce the likelihood of extirpation from federal lands. Specific protection of known sites would virtually eliminate the risk of extirpation. Additional surveys and protection would significantly increase the likelihood that the species would remain well-distributed within its range.

I. Species. *Oreohelix n. sp.*

II. FEMAT Rating. 40-35-15-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species habitat is generally schist talus in forested sites, so it may be subject to disturbance from road building and maintenance.

B. Past Actions. Not applicable.

C. Species Range. The species is known from only a single site on the Wenatchee National Forest near Lake Chelan.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. This is a newly discovered species whose description has not yet been published. The extent of the species range is unknown since it has only been demonstrated at one site.

F. Features of the Alternative. It is difficult to assess effects of the alternative on the species since it is known from only one site.

V. **Cumulative Effects Assessment.** Presence of the species on nonfederal land is not known.

VI. **Summary.** The species is known from only 1 site. It is a talus associate, so is not protected by riparian reserves. Thus, the rating for the species is based largely on uncertainty about how the alternative would affect the species. Any disturbance of local populations could be considered a serious impact, and the species could potentially be disturbed by activities both inside and outside LSRs.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Mitigation should be applied within the known species range, and survey efforts should be made to determine the full extent of the range.

B. **Specific Habitats.** Habitat to be protected is schist talus in forested settings

C. **Mitigation Measures.** The first level of mitigation would be protection of the currently known sites. Buffers of 10 acres or smaller could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. Specific protection must also be provided within LSRs since proposed management in the LSRs could impact the species. The highest priority should be given to surveys that would precede road building or maintenance activities, or rock quarrying.

D. **Benefits.** Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. **Species.** *Pristoloma articum crateris*

II. **Original FEMAT Rating.** 40-37-17-7

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** The species is thought to occur in subalpine and alpine habitats in association with leaf litter or cushion plants. The major impact to the species is likely to be from grazing.

B. **Past Actions.** Not applicable.

C. **Species Range.** The species is only known from one site in Crater Lake National Park. However, species experts think that it could be more widely distributed in high elevation areas of the Winema and Fremont National Forests.

D. **Non-habitat Factors.** Not applicable.

E. **Inadequate Information.** Not applicable.

F. **Features of the Alternative.** It is difficult to assess the effects of the alternative since it is known from only one site.

V. **Cumulative Effects Assessment.** There are no known sites on nonfederal lands.

VI. **Summary.** The rating reflects the potential for the species to be disturbed by grazing, and uncertainty about what level of protection is afforded by the alternative.

VII. **Mitigation.** Possible.

A. **Geographic Extent.** Mitigation should be applied within the species range which is thought to include the Winema and Fremont National Forests.

B. **Specific Habitats.** Habitat is high elevation. The species is thought to occur in leaf litter or among cushion plants in alpine and subalpine areas.

C. **Mitigation Measures.** Mitigation would require survey and protection of sites. Surveys are difficult, requiring sampling of leaf litter and filtration operations. Protection of discovered sites could be fairly simple as entire colonies occur in areas as small as several square feet. Priority for mitigation measures should be given to areas that are being grazed or are proposed for grazing.

D. **Benefits.** Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. **Species.** *Trilobopsis roperi*

II. **FEMAT Rating.** 37-30-23-10

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Species is associated with limestone ridges and talus slopes which are subject to disturbance, especially associated with roadbuilding.

B. **Past Actions.** Not applicable.

C. **Species Range.** Species has restricted range in the vicinity of Shasta Lake

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Of the known species locations, 3 are on private land, one is in matrix, and one is now under Shasta Lake. Because the species is not riparian associated, the riparian reserves are not expected to provide substantial protection.

V. Cumulative Effects Assessment. Cumulative effects are clearly a concern with *T. roperi* as 3 of the 4 known sites are on nonfederal land. Negative impacts on nonfederal land would reduce the overall likelihood of species persistence, but the population on federal land could probably be sustained under appropriate management.

VI. Summary. The rating for *T. roperi* reflects the finding that much of the species range is in matrix under Alternative 9, and the species is not expected to be directly benefited by riparian reserves. Thus, there is significant chance that local populations could be eliminated, which could result in the species being restricted to refugia.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Mitigation would be applied within the species range in the vicinity of Shasta Lake.

B. Specific Habitats. Limestone ridges and talus slopes.

C. Mitigation Measures. The first level of mitigation would be protection of the known species locations. Reserves of tens of acres could be effective in providing for these sites. The second level would be surveys of the suspected species range to determine the locations of additional species sites. These would be protected in turn. Surveys prior to road building, or substantial road maintenance, would be particularly important. Surveys could be done in conjunction with surveys for *Monadenia churchi* and *M. troglodytes*.

D. Benefits. Protection of known sites would reduce the likelihood of species extirpation from federal land. Additional surveys and protection, especially prior to road building, would greatly reduce the risk of species extirpation from federal land. However, because of the nature of the species distribution, there would still be some likelihood that it would either be restricted to refugia or extirpated.

I. Species. *Trilobopsis tehamana*

II. FEMAT Rating.

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The species is weakly associated with riparian zones. Some of its locations are in rockslides, but these are probably within riparian areas.

B. Past Actions. Not applicable.

C. Species Range. *T. tehamana* has a peculiar distribution that actually brackets *T. roperi* on the north and south. Further review of taxonomy may be appropriate in this complex. For now, the species has a limited but disjunct range.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Taxonomy of the species needs to be clarified to determine if the northern and southern populations represent distinct species.

F. Features of the Alternative. Under Alternative 9, the species known locations are distributed as follows: 2 on nonfederal land, 2 on matrix, and 2 out of the range of the Northern Spotted Owl.

V. Cumulative Effects Assessment. Cumulative effects are clearly a concern with *T. tehamana* as of the known sites are on nonfederal land, and 2 other sites are out of the range of the Northern Spotted Owl. Negative impacts on nonfederal land would reduce the overall likelihood of species persistence, but the population on federal land could probably be sustained under appropriate management.

VI. Summary. The rating for *T. tehamana* reflects the finding that much of the species range is in matrix under Alternative 9, and the species is only partially associated with riparian areas. Thus, there is significant chance that local populations could be eliminated, which could result in the species being restricted to refugia.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Mitigation would be restricted to the portion of the species range within the range of the northern spotted owl.

B. Specific Habitats. Mitigation should be applied within riparian habitats and rockslides on surrounding sideslopes.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. If species locations are found to occur outside the riparian reserves, additional small buffers could be established to help preserve those sites. Such buffers could be small, in the range of tens of acres. Visual surveys are effective but labor-intensive, and identifications need to be verified with a mollusc taxonomist. They could likely be conducted in conjunction with surveys for other species. *T. tehamana* has been noted to co-occur with *M. fidelis*

leonina.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. In combination, the mitigation would substantially increase the likelihood that *T. tehamana* would remain relatively well-distributed within its range on federal land.

I. Species. *Vertigo n. sp.*

II. FEMAT Rating. 35-25-25-15

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Both known sites were found in leaf litter at the base of wooded slopes near streams.

B. Past Actions. Not applicable.

C. Species Range. The species is known from only two sites along the Hoko River in the northwestern Olympic Peninsula. Sites are not on federal land, but it is speculated that the species also occurs on the Olympic National Forest.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. This is a newly-discovered species whose description has not yet been published, and whose range is very poorly understood.

F. Features of the Alternative. The species is a riparian associate and should benefit from the protection provided by the riparian reserves. However, there is uncertainty about riparian protection in the Olympic AMA.

V. Cumulative Effects Assessment. The known sites are from nonfederal land, so management of nonfederal lands may have a significant effect on the future distribution of the species. The significance of cumulative effects is difficult to determine at this time since the species range is so poorly understood.

VI. Summary. The FEMAT rating for the species is based largely on uncertainty about the total range of the species and the type of riparian standards that will be applied within the Olympic AMA.

VII. Mitigation. Possible.

A. **Geographic Extent.** Mitigation should be applied within the species range in the Olympic Peninsula

B. **Specific Habitats.** Riparian areas

C. **Mitigation Measures.** 1) Ensure that the riparian reserves are properly implemented. 2) Ensure riparian reserve standards applied within the Olympic AMA are consistent with those applied elsewhere. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Surveys require sampling of leaf litter. The first priority for surveys should go to the areas nearest the Hoko River in the Olympic AMA.

D. **Benefits.** 1) Proper implementation of the riparian reserves could provide protection for some newly discovered sites. 2) Strengthening of riparian reserve standards in the Olympic AMA will provide protection for future discovered sites and eliminate the uncertainty associated with current AMA direction. 3) Inventory would provide a much higher level of certainty that appropriate sites are actually being protected for the species, and would allow specificity for other mitigation measures on a site-specific basis.

I. **Species.** *Vespericola depressa*

II. **FEMAT Rating.** 43-35-22-0

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Habitat is generally springs and seeps within talus. It appears to do best within forested talus. In places it co-occurs with the Larch Mountain Salamander and with several species of *Monadenia* and *Cryptomastix*.

B. **Past Actions.** The species is now found only in scattered sites within its original range.

C. **Species Range.** Range is restricted to the Columbia Gorge.

D. **Non-habitat Factors.** Not applicable.

E. **Inadequate Information.** Not applicable.

F. **Features of the Alternative.** Under Alternative 9, the species should receive substantial protection from both riparian reserves and LSRs.

V. **Cumulative Effects Assessment.** Species also occurs on nonfederal land, so its future

distribution will be partly determined by management of the nonfederal sites.

VI. Summary. The rating reflects the rarity of the species, and uncertainty over proper implementation of reserve direction.

VII. Mitigation. Possible.

A. Geographic Extent. Mitigation would be restricted to the species range within the Columbia Gorge

B. Specific Habitats. Mitigation should be applied within riparian habitats.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented, and that riparian reserves are given full protection within LSRs. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but dissection is required for positive identification.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. In combination, these measures would significantly increase the likelihood that the species would remain well-distributed within its range, although the distribution will remain somewhat discontinuous since springs and seeps are discontinuous.

I. Species. *Vespericola euthales*

II. FEMAT Rating. 40-40-20-0

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species is a riparian associate

B. Past Actions. Not applicable.

C. Species Range. Species is actually quite broadly ranging in Del Norte, Humboldt and Mendocino counties, California. Of 17 known locations, one is in Redwood National Park, 9 are on private land, 6 are in state parks, and 1 is on county land.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. None of the known species locations are on National Forests or BLM land. Significant areas of LSR surround the known species locations, so additional species sites may occur within LSR. Where they are not contained within LSRs, species locations should receive substantial protection from the riparian reserves.

V. Cumulative Effects Assessment. Cumulative effects play a strong role with *V. euthales*. Populations in state parks probably receive reasonable protection, while those on private land may be subject to disturbance. Nonfederal lands will obviously play a key role in determining whether the species remains well-distributed.

VI. Summary. Known species locations are not influenced by the proposed action as they are not on federal land. Currently unknown portions of the species range likely receive substantial protection from both the LSRs and the riparian reserves in Alternative 9.

VII. Mitigation. Mitigation is possible to increase information on the level of protection provided to *V. euthales* under the proposed action.

A. Geographic Extent. Mitigation would apply within the species range in Del Norte, Humboldt and Mendocino Counties.

B. Specific Habitats. Mitigation should be applied within riparian habitats.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist. Dissection is often needed for positive identifications.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed.

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- I. Species. *Vespericola pressleyi*
 - II. FEMAT Rating. 20-40-30-10
 - III. Modifications due to changes in Alternative 9.
 - IV. Explanation of Rating.
 - A. Natural History. Not applicable.
 - B. Past Actions. Not applicable.

C. Species Range. The distribution of the species is very localized, and it is only known from 4 locations within that distribution.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Of the 4 known locations, 2 are in wilderness, 1 is in the Hayfork AMA, and one is on private land.

V. Cumulative Effects Assessment. One of the species known locations is located on private land. Since this constitutes 25 percent of the known locations, loss of the species from the site would be considered significant. However, loss of a site on private land would not have a major influence of the ability of the species to persist on federal land. The sites currently exist as isolated populations with little or no interchange.

VI. Summary. The rating reflects the rare and localized nature of the species distribution and uncertainty about the fate of one or more of the localized populations under Alternative 9. Of the alternatives considered by FEMAT, only Alternative 1 rate better for the species, suggesting that a very significant increase in reserves was needed to improve the prognosis for the species.

VII. Mitigation. Some mitigation is possible.

A. Geographic Extent. Mitigation for the species would be applied in and around the Hayfork AMA. However, the species may also occur further north in the Trinity Alps, and additional field work is necessary to determine the northern limit of the species range.

B. Specific Habitats. Mitigation is recommended for riparian habitats. However, the species is only partly riparian associated, so mitigation in other habitats is also possible.

C. Mitigation Measures. 1) Insure full implementation of riparian reserve standards. 2) Ensure that riparian reserve standards applied in the Hayfork AMA are consistent with those applied elsewhere. 3) Survey for the species to determine its full range. Visual surveys can be used, but the species is difficult to identify, requiring dissection for positive identification. 4) Provide additional protection for species sites found outside of riparian reserves. Small reserves, on the order of 10 acres, would provide significant benefit for newly discovered sites.

D. Benefits. Implementation of measures 1 and 2 should provide protection for all known sites on federal lands. Measure 3 would provide much greater knowledge of the status of the species and the level of protection being provided by Alternative 9. Measure 4 would be effective in protecting newly discovered sites, and could significantly improve the prognosis for the species under Alternative 9. However, since the species is only partially riparian, surveys would have to be extensive.

-
- I. Species. *Vespericola shasta*
- II. FEMAT Rating. 30-33-27-10
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating
- A. Natural History. Species is found in both riparian sites and in mouths of caves.
 - B. Past Actions. Not applicable.
 - C. Species Range. Not applicable.
 - D. Non-habitat Factors. Not applicable.
 - E. Inadequate Information. Not applicable.
 - F. Features of the Alternative. Under Alternative 9, 2 of the known locations are in LSR, 1 is in matrix, 1 is in a mixture of matrix and administrative withdrawal, 2 others are in administrative withdrawal, 2 are on private land, and 1 is in a state park.
- V. Cumulative Effects Assessment. Nonfederal habitats will play a role in determining whether the species will remain well-distributed within its range. The role of nonfederal lands is not reflected in the current rating, and would probably decrease the likelihood that the species will remain well-distributed. However, species persistence on federal land will primarily be determined by management of those lands.
- VI. Summary. Under Alternative 9, several of the species local populations are on lands that do not provide for strong protection. The species is not strictly a riparian associate, so those sites would not necessarily be protected by riparian reserves. Elimination of these sites could cause reduction in the species range, including some likelihood of extirpation from federal land.
- VII. Mitigation. Mitigation is possible.
- A. Geographic Extent. Mitigation would be restricted to the species range in Trinity and Shasta Counties, primarily in the vicinity of Shasta Lake
 - B. Specific Habitats. Mitigation should be applied within riparian habitats and caves.
 - C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Provide buffers that are a minimum of 2 tree heights in radius surrounding cave mouths within the species range. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the

proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist. 4) Provide additional site specific mitigation if necessary at sites where species is located.

D. Benefits. Proper implementation of the riparian reserves and protection of cave mouths should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed. In combination, the mitigation should provide high likelihood that the species would not be extirpated from federal land, and would increase the likelihood that it would remain well-distributed.

I. Species. *Vespericola sierranus*

II. FEMAT Rating. 43-33-17-7

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. *V. sierranus* is primarily a riparian associate. Its locations include spring seeps and leaf litter along streambanks.

B. Past Actions. Not applicable.

C. Species Range. The species has a quite broad range in Oregon and California, but none of the known species locations occur on federal land. A significant portion of the species range occurs outside the range of the Northern Spotted Owl. The species may occur largely at elevations below National Forests.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. If the species range extends to federal lands covered by this proposed action, those locations are likely protected by riparian reserves.

V. Cumulative Effects Assessment. Actions on nonfederal lands, and outside the range of the Northern Spotted Owl, will play the dominant role in determining the future status of the species.

VI. Summary. There is essentially no information about how the proposed action will affect this species. The projected possibility of extirpation from federal lands was based simply on uncertainty about species locations and how those locations would be affected by the alternative.

VII. Mitigation. The appropriate mitigation is to gather more information.

A. Geographic Extent. Mitigation would be restricted to the species range in Jackson County, Oregon and Siskiyou County, California.

B. Specific Habitats. Mitigation should be applied within riparian habitats.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but a trained taxonomist needs to make final identifications..

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species if it occurs on federal lands. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed.

I. Species. *Vespericola undescribed #1*

II. FEMAT Rating. 40-30-20-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species appears to be a strong riparian associate.

B. Past Actions. Not applicable.

C. Species Range. Species probably has a very limited distribution within Siskiyou County, California.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Species is known from only a single location, which is within matrix in Alternative 9. However, the riparian association of the species suggests that it is probably reasonably protected by riparian reserve.

V. Cumulative Effects Assessment. None of the known species locations are off federal land.

VI. Summary. This is a recently discovered species, currently known from only a single site. Based on its riparian association, it is reasonable to expect that Alternative 9 provides

reasonable protection for the species. The original rating in FEMAT is largely a reflection of uncertainty about the species and about the exact provisions of Alternative 9.

VII. Mitigation. Mitigation would consist of gathering more information about the species and verifying the effect of Alternative 9 on it.

A. Geographic Extent. Mitigation would be restricted to the species range which is probably restricted to Siskiyou County, California

B. Specific Habitats. Mitigation should be applied within riparian habitats.

C. Mitigation Measures. The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be confirmed by a taxonomist.

D. Benefits. Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed.

I. Species. *Vespericola undescribed #2*

II. FEMAT Rating. 30-30-30-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species appears to be a strong riparian associate.

B. Past Actions. Not applicable.

C. Species Range. Species is newly discovered and probably endemic to the coast range in Humboldt County, California. Sites are inland, not near the coast. None of its known locations are on federal land, and it probably does not have significant range on federal land.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Since the species is not currently known on federal land, it is difficult to assess how it is affected by the proposed action.

V. **Cumulative Effects Assessment.** Nonfederal lands will have the dominant effect on the future distribution and abundance of the species. Of the 3 currently known locations, 2 are on private land and one is in Richardson Grove State Park.

VI. **Summary.** The species is not currently known from federal land and its range on federal land may be very limited. However, the species is a riparian associate, so it will likely be benefited by riparian reserves if it does occur on federal lands. The original FEMAT rating expresses uncertainty over the species distribution and habitat association.

VII. **Mitigation.** Mitigation would consist of gathering more information on the species and determining the level of protection afforded by Alternative 9.

A. **Geographic Extent.** Mitigation would be restricted to the species range which is a restricted area of Humboldt and Mendocino Counties, California.

B. **Specific Habitats.** Mitigation should be applied within riparian habitats.

C. **Mitigation Measures.** The following mitigation would be applied . 1) Ensure that the riparian reserves are properly implemented. 2) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective, but identifications should be verified by a mollusc taxonomist.

D. **Benefits.** Proper implementation of the riparian reserves should provide substantial protection to the species. Surveys should provide a better understanding of the species status, and would allow the application of additional mitigation on a site specific basis if they are needed.

I. **Species.** *Deroceras hesperium*

II. **FEMAT Rating.** 30-30-20-20

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Species likely occurs both in riparian reserves and in intact old-forest stands in upland areas.

B. **Past Actions.** Species was originally quite widely distributed on the west side of the Cascades, but now is only known from 3 locations.

C. **Species Range.** The 3 known locations are on the Olympic Peninsula, but it is thought that the species is still distributed throughout the western Cascades from British Columbia to the lower Columbia River.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. The riparian reserves should provide some protection for the species, but will not protect all sites. Effectiveness of specific LSRs is impossible to determine since the species is only known from 3 sites within a range that may be extensive.

V. Cumulative Effects Assessment. Extent of the species current range on nonfederal land is not known.

VI. Summary. The rating reflects uncertainty about the number of species locations that would be protected by riparian reserves or LSRs under the proposed action or any other A alternative. Given this uncertainty, there is some likelihood that the species could be extirpated from some parts of its range.

VII. Mitigation. Possible.

A. Geographic Extent. Mitigation should be applied within the species range from the Olympic peninsula to the Columbia Gorge

B. Specific Habitats. Habitat to be protected is intact stands of older forest, generally characterized by high vegetative diversity. Some of the species sites may be in riparian reserves, but the species does not have a strong riparian association.

C. Mitigation Measures. The first level of mitigation would be protection of the currently known sites. Buffers as small as 10 acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. Identifications should be verified by a mollusc taxonomist, and nearly always require dissection. Surveys should be conducted both inside and outside LSRs so that we can determine the full extent of the species range, and the degree to which it is protected in existing allocations. Specific protection must also be provided within LSRs since proposed management in the LSRs could impact the species.

D. Benefits. Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. Species. *Hemphillia burringtoni*

II. FEMAT Rating. 33-27-20-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species is a riparian associate

B. Past Actions. The species may have been common at one time throughout the Olympic Peninsula and the western Washington Lowlands. It may now be restricted to the Peninsula.

C. Species Range. All known sites are on the Olympic Peninsula including the Olympic National Forest, Olympic National Park, and Bush Pacific State Park.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Under Alternative 9, the sites on the Olympic National Forest may be in AMA

V. Cumulative Effects Assessment. The portion of the range on nonfederal land is unknown, but past management of the Willapa Hills may have contributed to a significant reduction in species range.

VI. Summary. The rating for the species is based on the possible reduction from its historic distribution, the lack of knowledge of its current status, and the lack of specific protection in the Olympic AMA.

VII. Mitigation. Possible.

A. Geographic Extent. Mitigation should be applied within the species range, currently thought to be restricted to the Olympic Peninsula

B. Specific Habitats. Habitats probably include both riparian areas and intact forest on upland sites.

C. Mitigation Measures. 1) Ensure that the riparian reserves are properly implemented. 2) Ensure that riparian reserve standards applied within the Olympic AMA are consistent with those applied elsewhere. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective. 4) Establish small buffers around newly-discovered sites that are not otherwise protected.

D. Benefits. 1) Proper implementation of the riparian reserves should provide for substantial protection of both known and newly discovered sites. 2) Strengthening of riparian reserve standards in the Olympic AMA should provide protection for some currently undiscovered sites. 3) Inventory would provide a much higher level of

certainty that appropriate sites are actually being protected for the species, and would allow the application of site-specific mitigation such as small buffers around unprotected sites. In combination, these measures should substantially reduce the likelihood of species extirpation from federal land.

I. Species. *Hemphillia glandulosa*

II. FEMAT Rating. 20-33-30-17

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species is located in old, intact forest stands at low to mid-elevations, some of which may be located in riparian areas

B. Past Actions. Logging may have extirpated the species from large parts of its range, which may have historically included the Willapa Hills.

C. Species Range. The extent of the species' current range is unknown, but historic sites were located on the Olympic National Forest and Park and may still be extant. The range also could still extend to the Gifford Pinchot.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Not applicable.

V. Cumulative Effects Assessment. It is thought that some sites still exist on private land near Olympia. However, the species has probably been extirpated from most of its range on private land, so future management of private land may no longer be a major factor.

VI. Summary. The rating is based on the large historic range reduction, uncertainty about the species' current status, and lack of knowledge of how well existing locations are protected by the features of Alternative 9.

VII. Mitigation. Possible.

A. Geographic Extent. Mitigation should be applied within the species range, currently thought to be restricted to the Olympic Peninsula

B. Specific Habitats. Habitats probably include both riparian areas and intact forest on upland sites.

C. Mitigation Measures. 1) Ensure that the riparian reserves are properly

implemented. 2) Ensure that riparian reserve standards applied within the Olympic AMA are consistent with those applied elsewhere. 3) Conduct inventories within the known and expected species range to determine the extent of the range and the degree of protection afforded by the proposed action. Visual surveys are effective. 4) Establish small buffers around newly-discovered sites that are not otherwise protected.

D. Benefits. 1) Proper implementation of the riparian reserves should provide for substantial protection of both known and newly discovered sites. 2) Strengthening of riparian reserve standards in the Olympic AMA should provide protection for some currently undiscovered sites. 3) Inventory would provide a much higher level of certainty that appropriate sites are actually being protected for the species, and would allow the application of site-specific mitigation such as small buffers around unprotected sites. In combination, these measures should substantially reduce the likelihood of species extirpation from federal land.

I. Species. *Hemphillia malonei*

II. FEMAT Rating. 28-28-25-18

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Habitat is moist forest, not necessarily in riparian areas.

B. Past Actions. Not applicable.

C. Species Range. Species range is thought to be restricted to the western end of the Columbia River Gorge.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. LSRs in Alternative 9 should provide substantial protection for the species

V. Cumulative Effects Assessment. There are no known sites on nonfederal land

VI. Summary. The rating is based on the restricted range of the species and uncertainty about the possible effects of activities proposed in LSRs.

VII. Mitigation. Possible.

A. Geographic Extent. Mitigation should be applied within the species range in the

Columbia River Gorge

B. Specific Habitats. Habitat to be protected is undisturbed moist forest. Some of the species sites may be in riparian reserves, but the species does not have a strong riparian association.

C. Mitigation Measures. The first level of mitigation would be protection of the currently known sites. Buffers as small as 10 acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are effective for the species, and can be completed within a single year. Most of the species' sites are probably within LSRs, but specific protection should be provided within LSRs since proposed management in the LSRs could impact the species.

D. Benefits. Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. Species. *Hemphillia pantherina*

II. FEMAT Rating. 32-25-22-22

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. The only known location was reported in deep forest litter in a riparian zone.

B. Past Actions. Not applicable.

C. Species Range. The species is only known from the original type locality at Miller Creek Crossing on the Gifford Pinchot. It has not been relocated at the site, or located at any other site.

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. The type locality is near an LSR, but it is difficult to tell if it is LSR or matrix. Riparian reserves may provide some protection for the species.

V. Cumulative Effects Assessment. No sites are known from nonfederal lands.

VI. Summary. The rating is based on lack of specific information about the species range or locations, or the effect of the proposed action.

VII. Mitigation. Possible.

A. Geographic Extent. Apply near the one historic species location

B. Specific Habitats. Deep forest litter, possibly near streams

C. Mitigation Measures. Surveys should be conducted for the species. If locations are found without specific protection, small buffers should be established.

D. Benefits. Mitigation is problematic since the species is so poorly known. If sites can be located, they can probably be easily protected.

I. Species. *Prophysaon coeruleum*

II. FEMAT Rating. 50-25-15-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in relatively undisturbed, moist coniferous forests from low to middle elevations

B. Past Actions. Species was originally widely distributed from the south Puget Sound down into the Willamette Valley. Many of the historic sites are now within heavily-urbanized areas.

C. Species Range. No locations are currently known

D. Non-habitat Factors. Not applicable.

E. Inadequate Information. Not applicable.

F. Features of the Alternative. Not applicable.

V. Cumulative Effects Assessment. Historic sites were on nonfederal land, but their status is currently unknown.

VI. Summary. The rating for the species is based on failure to relocate historic sites; conversion of much of the historic range to urban area; and uncertainty about the effects of the proposed action.

VII. Mitigation. Problematic.

- A. **Geographic Extent.** Species range in Puget trough
 - B. **Specific Habitats.** Relatively undisturbed, moist forest
 - C. **Mitigation Measures.** Resurvey historic sites, and search for species in other similar sites. Searches in this case would be very extensive, and would probably have to enlist volunteer efforts and strategies such as "wanted" posters in forest and district offices. If species is found, ensure that sites are protected.
 - D. **Benefits.** Mitigation is problematic because of the rarity of the species.
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I. **Species.** *Prophyaon dubium*

II. **FEMAT Rating.** 57-23-17-3

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Species is a partial riparian associate, but is also found in rockslide areas. Roadbuilding and maintenance are potential disturbances in these rockslide areas. The species appears to be truly rare.

B. **Past Actions.** Not applicable.

C. **Species Range.** Species range is very large, but not particularly well known. Its known range currently includes Pierce County, Washington; Clackamas and Hood River Counties, Oregon; and Trinity County, California. It is not known how much of the intervening land is actually occupied by the species. The range may contain some large gaps.

D. **Non-habitat Factors.** Not applicable.

E. **Inadequate Information.** Not applicable.

F. **Features of the Alternative.** Under Alternative 9, the one location on federal land is in an AMA. Riparian reserves should provide some protection for the species, but will not provide protection for species locations in rockslide areas.

V. **Cumulative Effects Assessment.** Since the range of the species is large, but not known in detail, it is likely that management of nonfederal land will have a significant effect on the species future distribution. However, the level of this effect is difficult to assess.

VI. **Summary.** The FEMAT rating reflects significant uncertainty about the specific distribution of the species, rarity of the species, and resulting uncertainty about how it will be affected by Alternative 9. Over time, the species could be restricted to refugia within

LSRs if a large portion of sites outside LSRs are disturbed.

VII. Mitigation. Mitigation may be possible, but would be quite difficult.

A. Geographic Extent. The species range is broad, but species occurrence appears to be quite spotty within that range. Surveys would have to be broad, but mitigation would only be applied where the species was found.

B. Specific Habitats. Habitats to be protected. Some of the species sites may be in riparian reserves, but the species does not have a strong riparian association.

C. Mitigation Measures. The first level of mitigation would be protection of any currently known sites. Buffers as small as 10 acres could be effective in providing for local populations. Additional mitigation would require surveying for species' sites and protecting them when found. Visual surveys are possible, but identification of the species is difficult. Since surveys must be conducted within rockslides, they are labor-intensive. The large extent of the species range, and its rarity, make this task even more difficult. The first priority would be to survey prior to roadbuilding or maintenance activities. Specific protection should also be provided within LSRs since proposed management in the LSRs could impact the species.

D. Benefits. Surveys for the species and protection of small buffers could be effective in providing for a very large percentage of the species' known and currently unknown sites. This should provide a high level of assurance that the species would be maintained on federal lands.

I. Species. *Fisherola nuttalli nuttalli* shortface lanx

II. FEMAT Rating. 35-30-25-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Found in unpolluted, swift-flowing, highly oxygenated water on boulder and gravel substrates, often in vicinity of rapids, in small to large rivers. Individuals have no lungs or gills with respiration through the mantle cavity. Highly sensitive to low dissolved oxygen. Obligate lithophiles. Semelparous- lives 1+ year, breeds and dies. Population turn over annually is greater than 90%. Damage to mantle will be fatal.

B. Past Actions.

C. Species Range. Formerly widespread in lower Columbia River, Snake River and a

few major tributaries. Currently becoming restricted to refugia due to habitat degradation. Still survives in the lower Deschutes River, lower Columbia River and a few sites in the Columbia Basin outside of the planning area.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Hydropower development on the Columbia River has destroyed much of this species former habitat. Also irrigation diversions, siltation and fluctuations in dissolved oxygen caused by pollution have also contributed. Many populations probably occur on nonfederal lands, so cumulative effects are a major concern for this species.

VI. Summary. The distribution of this species has been severely restricted due to water pollution, hydropower development and siltation. Cumulative impacts from activities on nonfederal lands suggests that this species may be restricted to federal lands in the future. The species is federally listed in category 3.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Formerly widespread in lower Columbia River, Snake River and a few major tributaries. Currently becoming restricted to refugia due to habitat degradation. Still survives in the lower Deschutes River, lower Columbia river and a few sites in the Columbia Basin outside of the planning area.

B. Specific Habitats. Found in unpolluted, swift-flowing, highly oxygenated water on boulder gravel substrate, often in vicinity of rapids, in small to large rivers.

C. Mitigation Measures. 1) Conduct inventories to better establish distribution, 2) control siltation, 3) prevent fluctuations in dissolved oxygen, 4) protect remaining identified habitats, 5) implement buffer strips.

D. Benefits. 1) Proper implementation of buffer strips should provide some protection for this species, 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species, 3) This species sometimes co-occurs with *Fluminicola columbiana*, so both species may benefit from protection of associated habitat.

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- I. Species.** *Fluminicola columbiana* Columbia pebblesnail
- II. FEMAT Rating.** 35-30-25-10
- III. Modifications due to changes in Alternative 9.**

IV. Explanation of Rating.

A. Natural History. Found in small to large rivers, not spring-associated, on cobble substrates. A very sensitive species. Semelparous- 1 year life cycle, so the population is replaced annually.

B. Past Actions.

C. Species Range. In the Columbia River and some larger tributaries up the Snake River into WY.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Hydropower development on the Columbia River has destroyed much of this species former habitat. Also irrigation diversions, siltation and fluctuations in dissolved oxygen caused by pollution. Many populations probably occur on nonfederal lands, so cumulative effects are a major concern for this species.

VI. Summary. The species is federally listed in category 2.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Columbia River and some of its larger tributaries up the Snake River into WY.

B. Specific Habitats.

C. Mitigation Measures. 1) Conduct inventories to better establish distribution, 2) control siltation, 3) prevent fluctuations in dissolved oxygen, 4) protect remaining identified occupied habitats, and 5) implement buffer strips.

D. Benefits. 1) Proper implementation of buffer strips should provide some protection for this species, 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species, 3) This species sometimes co-occurs with *Fisherola nuttalli nuttalli*, so both species may benefit from protection of associated habitat.

I. Species. *Fluminicola* n. sp. 1. suggested Klamath pebblesnail

II. FEMAT Rating. 40-20-30-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in spring-influenced lakes, larger tributaries of Klamath Lake, the Klamath River and rarely in large springs. A lithophile that appears to avoid dense macrophyte beds. This species has a one-year life span.

B. Past Actions.

C. Species Range. Sporadically in middle and upper Klamath River, Siskiyou Co., CA.; Upper Klamath Lake and major spring-fed tributaries, Klamath Co., OR. including sites in Winema and Rogue River National Forests and Upper Klamath Lake National Wildlife Refuge.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Some occurrences are within or near the LSR on the west side of Upper Klamath Lake. Also possibly occurs in administratively withdrawn sites along the Klamath River. One known site occurs within the matrix.

V. Cumulative Effects Assessment. Agriculture and grazing impacts in the vicinity of Klamath Lake have degraded water quality and suitable habitat. Reservoir and hydroelectric development on the Klamath River has extirpated the species from much of the river.

VI. Summary. This species is difficult to evaluate because its distribution is poorly known, however considerable protection should be provided by riparian reserves.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Occurs in the middle and upper Klamath River, Siskiyou Co., CA.; Upper Klamath Lake and major spring-fed tributaries, Klamath Co., OR.

B. Specific Habitats.

C. Mitigation Measures. 1) Establish reserves to protect sensitive areas, particularly tributaries to Upper Klamath Lake and Klamath River east of Interstate-5, below Boyle Reservoir.

D. Benefits. 1) Proper implementation of riparian buffer strips should provide protection for this species, 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species, 3) This species sometimes co-occurs with other endemic *Fluminicola* spp., *Lanx alta*, and *Lanx klamathensis*, *Lyogyrus* spp., *Helisoma newberryi*, or *Pisidium ultramontanum* so all of these species may benefit from protection of associated habitat.

- I. Species. *Fluminicola* n. sp. 2. suggested Tall pebblesnail
- II. FEMAT Rating. 30-20-25-25
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating.
 - A. Natural History. Obligate spring dweller, local endemic, lithophile, also on large *Nostoc* colonies (Mare's eggs). Occurs only in shaded areas and may be photophobic. May be a new genus. Life span is one year.
 - B. Past Actions.
 - C. Species Range. Known from a single site on private land located on the west side of Upper Klamath Lake. May also occur on Upper Klamath Lake National Wildlife Refuge on west side of lake, and Winema N.F.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative. Believed to occur within or near the LSR on the west side of Upper Klamath Lake.
- V. Cumulative Effects Assessment. Agriculture, spring diversion and grazing impacts in the vicinity of Klamath Lake have degraded water quality and suitable habitat.
- VI. Summary. This species should receive substantial protection from riparian reserves. Recent habitat degradation and rarity contributed to the rating which could be improved considerably by proper implementation of option 9.
- VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent. Known from a single site on private land located on the west side of Upper Klamath Lake.
 - B. Specific Habitats. Obligate spring dweller.
 - C. Mitigation Measures. Conduct inventories to better establish distribution. protect them. Protect water supply from enrichment from organic pollution. Provide shade cover.
 - D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

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- I. **Species.** *Fluminicola* n. sp. 3. suggested Klamath Rim pebblesnail
- II. **FEMAT Rating.** 35-30-15-20
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. **Natural History.** One-year life cycle. Species is known from only three sites which are small, cold springs in shaded areas with gravel-cobble substrate. The species may be photophobic.
- B. **Past Actions.** Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.
- C. **Species Range.** Middle reaches of the Klamath River in scattered localities. Occurs in springs high above the flood plain.
- D. **Non-habitat Factors.**
- E. **Inadequate Information.**
- F. **Features of the Alternative.** Known sites are in a LSR with mixed federal and private ownership.
- V. **Cumulative Effects Assessment.** Grazing pressures on private lands have caused major habitat losses. Surviving populations may all be on federal land but they are in checkerboard ownership.
- VI. **Summary.** This species should receive substantial protection from riparian reserves. Recent habitat degradation and rarity contributed to the rating which could be improved considerably by proper implementation of option 9.
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.** Middle reaches of the Klamath River in scattered localities.
- B. **Specific Habitats.** Occurs in cold, shaded springs.
- C. **Mitigation Measures.** Conduct inventories of springs and seeps, and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.
- D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

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- I. Species. *Fluminicola* n. sp. 4. suggested nerite pebblesnail
- II. FEMAT Rating. 40-25-15-20
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating.
- A. Natural History. Local endemic. Occurs in large, cold springs with exceptionally good water quality, and their outflows on gravel-boulder substrates. Life span of one year.
 - B. Past Actions. Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.
 - C. Species Range. Known from several sites. All are tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.
- V. Cumulative Effects Assessment. Diversions to the municipal water supply for Yreka, CA. and some grazing impacts. Localities are in checkerboard ownership.
- VI. Summary. This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.
- VII. Mitigation. Mitigation is possible.
- A. Geographic Extent.
 - B. Specific Habitats.
 - C. Mitigation Measures. Conduct inventories of springs and seeps, and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.
 - D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with

other endemic *Fluminicola* spp. and *Juga acutifilosa* so several species may benefit from protection of associated habitat.

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- I. **Species.** *Fluminicola* n. sp. 5. suggested Toothed pebblesnail
- II. **FEMAT Rating.** 40-25-15-20
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. **Natural History.** Local endemic. Occurs in large, cold springs with exceptionally good water quality, and their outflows on gravel-boulder substrates. Life span is one year.
 - B. **Past Actions.** Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.
 - C. **Species Range.** Known from three sites, all are tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhauser) lands.
 - D. **Non-habitat Factors.**
 - E. **Inadequate Information.**
 - F. **Features of the Alternative.** Known localities are within a LSR and Tier 1 watershed.
- V. **Cumulative Effects Assessment.** Diversions to the municipal water supply for Yreka, CA. and some grazing impacts. Localities are on checkerboard ownership.
- VI. **Summary.** This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.** Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhauser) lands.
 - B. **Specific Habitats.** Occurs in very large, cold springs and their outflows.
 - C. **Mitigation Measures.** 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment. 2) This species is associated with endemic fish stocks such as the Jenny Creek sucker and Jenny Creek redband. Care should be taken to avoid impacts from

fish enhancement projects that would disturb substrates causing increased turbidity and deposition of fine sediments in habitat.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with other endemic *Fluminicola* spp. and *Juga acutifilosa* so several species may benefit from protection of associated habitat.

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- I. Species.** *Fluminicola* n. sp. 6. suggested Diminutive pebblesnail
- II. FEMAT Rating.** 40-25-15-20
- III. Modifications due to changes in Alternative 9.**
- IV. Explanation of Rating.**
- A. Natural History.** Local endemic. Occurs in large, cold springs with exceptionally good water quality, and their outflows on gravel-boulder substrates. One year life span.
 - B. Past Actions.** Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.
 - C. Species Range.** Known from three sites, all are tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.
 - D. Non-habitat Factors.**
 - E. Inadequate Information.**
 - F. Features of the Alternative.** Known localities are within a LSR and Tier 1 watershed.
- V. Cumulative Effects Assessment.** Diversions to the municipal water supply for Yreka, CA. and some grazing impacts. Localities are on checkerboard ownership.
- VI. Summary.** This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.
- VII. Mitigation.** Mitigation is possible.
- A. Geographic Extent.** Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.

B. Specific Habitats. Occurs in very large, cold springs and their outflows.

C. Mitigation Measures. 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment. 2) This species is associated with endemic fish stocks such as the Jenny Creek sucker and Jenny Creek redband. Care should be taken to avoid impacts from fish enhancement projects that would disturb substrates causing increased turbidity and deposition of fine sediments in habitat.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with other endemic *Fluminicola* spp. and *Juga acutifilosa* so several species may benefit from protection of associated habitat.

I. Species. *Fluminicola* n. sp. 7. suggested topaz pebblesnail

II. FEMAT Rating. 40-25-15-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in rocky, large spring runs. Photophobic.

B. Past Actions. Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.

C. Species Range. Very rare, found only in a small portion of Spring Creek, just below the confluence with Fall Creek, Jackson Co., OR.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.

V. Cumulative Effects Assessment. Diversions to the municipal water supply for Yreka, CA. and some grazing impacts.

VI. Summary. This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.

B. Specific Habitats. Occurs in very large, cold springs and their outflows.

C. Mitigation Measures. 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment. 2) This species is associated with endemic fish stocks such as the Jenny Creek sucker and Jenny Creek redband. Care should be taken to avoid impacts from fish enhancement projects that would disturb substrates causing increased turbidity and deposition of fine sediments in habitat.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with other endemic *Fluminicola* spp. and *Juga acutifilosa* so several species may benefit from protection of associated habitat.

I. Species. *Fluminicola* n. sp. 8. suggested Fall Creek pebblesnail

II. FEMAT Rating. 40-25-15-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in large, cold, pristine springs and their outflows. Common on gravel-cobble substrates associated with dense stands of water cress *Rorippa*.

B. Past Actions. Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.

C. Species Range. Occurs in large, cold, pristine springs and their outflows in cobble-gravel substrates associated with Jenny Creek, Jackson Co., OR. and similar habitats in Siskiyou Co., CA.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.

V. **Cumulative Effects Assessment.** Diversions to the municipal water supply for Yreka, CA. and a Pacific Gas & Electric hydropower project, some grazing impacts.

VI. **Summary.** This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.

B. **Specific Habitats.** Occurs in very large, cold springs and their outflows.

C. **Mitigation Measures.** 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment. 2) This species is associated with endemic fish stocks such as the Jenny Creek sucker and Jenny Creek redband. Care should be taken to avoid impacts from fish enhancement projects that would disturb substrates causing increased turbidity and deposition of fine sediments in habitat.

D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with other endemic *Fluminicola* spp. and *Juga acutifilosa* so several species may benefit from protection of associated habitat.

I. **Species.** *Fluminicola* n. sp. 9. suggested lunate pebblesnail

II. **FEMAT Rating.** 40-25-15-20

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Occurs in large spring runs with high discharge and current velocity, not in headwaters, on cobbles and boulders. May be photophobic.

B. **Past Actions.** Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.

C. **Species Range.** Quite rare, occurs in Jenny and Spring Creeks

D. **Non-habitat Factors.**

E. Inadequate Information.

F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.

V. Cumulative Effects Assessment. Diversions to the municipal water supply for Yreka, CA. and some grazing impacts.

VI. Summary. This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.

B. Specific Habitats. Occurs in very large, cold springs and their outflows.

C. Mitigation Measures. 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment. 2) This species is associated with endemic fish stocks such as the Jenny Creek sucker and Jenny Creek redband. Care should be taken to avoid impacts from fish enhancement projects that would disturb substrates causing increased turbidity and deposition of fine sediments in habitat.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with other endemic *Fluminicola* spp. and *Juga acutifilosa* so several species may benefit from protection of associated habitat.

I. Species. *Fluminicola* n. sp. 10. suggested Keene Creek pebblesnail

II. FEMAT Rating. 40-25-20-15

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in small to medium-sized springs and spring-influenced creeks.

B. Past Actions.

C. Species Range. Restricted to portions of the Jenny Creek drainage. Sites are on both BLM and private lands.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.

V. Cumulative Effects Assessment. Diversions to the municipal water supply for Yreka, CA. and major grazing impacts.

VI. Summary. This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.

B. Specific Habitats. Occurs in very large, cold springs and their outflows.

C. Mitigations Measures. 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Fluminicola* n. sp. 11. suggested Fredenburg pebblesnail

II. FEMAT Rating. 35-30-15-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in a narrow and shallow small, cold spring run on cobbles and gravel. Associated with habitats containing monkey flower *Mimulus* and water cress *Rorippa*.

B. Past Actions.

C. **Species Range.** A narrow endemic, historically probably restricted to a few spring runs tributary to the middle Klamath River drainage, Jackson Co., OR. Presently known from a single site, apparently on BLM land.

D. **Non-habitat Factors.**

E. **Inadequate Information.**

F. **Features of the Alternative.** Known localities are within a LSR and Tier 1 watershed.

V. **Cumulative Effects Assessment.** Severe impacts from road building and livestock grazing have occurred at the known locality and at many adjacent springs.

VI. **Summary.** This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Occurs in tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands.

B. **Specific Habitats.** Occurs in very large, cold springs and their outflows.

C. **Mitigations Measures.** 1) Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. **Species.** *Fluminicola* n. sp. 12. suggested Umpqua pebblesnail

II. **FEMAT Rating.** 25-30-30-15

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Occurs in relatively pristine headwaters and spring-influenced areas on gravel-cobble substrates. Not associated with macrophytes. Also found in medium-sized river along rocky shorelines in well oxygenated, shallow water with slow current velocities. Associated with indian asparagus (scientific name?).

B. Past Actions.

C. Species Range. Appears to be endemic to the headwaters of the Umpqua River. Presently known from only three sites on the North Fork of the Umpqua River, Umpqua National Forest, Douglas Co., OR. May occur in the South Fork of the Umpqua as well.

D. Non-habitat Factors.

E. Inadequate Information. More inventory work in the Umpqua Basin will be necessary to establish the distribution of this species.

F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.

V. Cumulative Effects Assessment. Construction of dams and reservoirs have submerged suitable habitats. Impacts from organic pollution.

VI. Summary. This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Endemic to the headwaters of the Umpqua River.

B. Specific Habitats. Occurs in pristine headwater springs and along rocky shorelines in medium-sized rivers with excellent water quality.

C. Mitigations Measures. Conduct inventories to better establish distribution. Maintain riparian corridor, control flashy hydrographs that would stress populations of the species. Avoid construction of diversion dams that will further destroy potential suitable habitat.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Fluminicola* n. sp. 13. suggested Sacramento pebblesnail

II. FEMAT Rating. 35-30-20-15

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in headwaters of upper Sacramento River on cobbles and boulders in moderately swift currents, generally near shore.

B. Past Actions. The Cantara toxic spill of 1991 apparently destroyed a large portion of the population in the Sacramento River. Individuals presently occur only above the spill and in a few isolated areas having significant spring influx below the spill.

C. Species Range. Apparently endemic to the upper Sacramento River, Shasta Co., CA. Known from only three sites, mostly private land.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Sites are within LSRs and Tier 1 watersheds.

V. Cumulative Effects Assessment. Impacts from activities such as water diversions on private lands adjacent to the Sacramento River. Most of the sites harboring populations that survived the toxic chemical spill are on private land.

VI. Summary. The populations on federal lands should receive adequate protection by virtue of their occurrence in LSRs. The relatively low rating originally assigned to this species reflects uncertainty about management of LSRs under option 9 and possible impacts on populations on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. The species is endemic to the upper Sacramento River, Shasta Co., CA.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories to better establish distribution. Maintain riparian corridor, control flashy hydrographs that would further stress populations of the species. Avoid construction of diversion dams that will further destroy potential suitable habitat.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Fluminicola* n. sp. 14. suggested Potem pebblesnail

II. FEMAT Rating. 40-20-20-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs on muddy-silty substrates in heavily shaded cold springs and spring runs. The species appears to graze on the surface of partly decayed deciduous leaves.

B. Past Actions.

C. Species Range. Known from six sites in tributaries to the upper Sacramento and Pit Rivers in Shasta Co., CA.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. The species occurs within a Tier 1 watershed. Adjacent federal lands are LSRs.

V. Cumulative Effects Assessment. With one possible exception within Shasta National Forest, all sites are on private land. Spring diversions and modifications are extensive in the area of occurrence.

VI. Summary. The rating given for this species indicates a concern about cumulative effects since the species predominately occurs on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Tributaries to the Upper Sacramento and Pit Rivers, Shasta Co., CA.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

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- I. Species.** *Fluminicola* n. sp. 15. suggested flat-top pebblesnail
- II. FEMAT Rating.** 40-20-20-20
- III. Modifications due to changes in Alternative 9.**

IV. Explanation of Rating.

A. Natural History. Confined mainly to small, cold springs in sand and gravel. In one instance found on a vertical seep. Appears to prefer shade. Feeds on periphyton on rocks. Not yet established as a deciduous leaf associate.

B. Past Actions.

C. Species Range. Known from four sites in tributaries to the upper Sacramento River in Shasta Co., CA. Historically, it also occurred in the Pit River.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. The species occurs within a Tier 1 watershed. Adjacent federal lands are LSRs.

V. Cumulative Effects Assessment. All known sites are on private land, however they are interspersed with extensive federal lands. Most suitable habitat is in Shasta National Forest and Whiskeytown-Shasta-Trinity National Recreation Area.

VI. Summary. The rating given for this species indicates a concern about cumulative effects since the species predominately occurs on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Tributaries to the upper Sacramento River.

B. Specific Habitats. Small, cold springs and seeps.

C. Mitigations Measures. Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Fluminicola* n. sp. 16. suggested Shasta pebblesnail

II. FEMAT Rating. 25-30-25-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Usually occurs in lower portions of large cold springs in water cress *Rorippa* beds and on cobbles and pebbles.

B. Past Actions.

C. Species Range. Known from 16 sites, all along the Sacramento River in the vicinity of Shasta Springs. About half the sites are on private land and half are on the Shasta National Forest.

D. Non-habitat Factors. The Cantara toxic chemical spill of 1991 may have affected portions of some populations.

E. Inadequate Information.

F. Features of the Alternative. The species occurs within a Tier 1 watershed. Adjacent federal lands are LSRs.

V. Cumulative Effects Assessment. Water diversions for municipal water supplies, track construction by the Southern Pacific Railroad, construction work on Interstate Highway 5 near Big Canyon Creek and Lake Siskiyou have all contributed to accelerated rates of sediment input to the Sacramento River and jeopardized this spring-restricted species.

VI. Summary. The rating given for this species indicates a concern about cumulative effects since the species predominately occurs on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Known only from Shasta Springs, tributary to the Sacramento River.

B. Specific Habitats. Large, cold springs.

C. Mitigations Measures. Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. Benefits: 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) May be associated with other endemic *Fluminicola* spp. and *Juga* (*Oreobasis*) n. sp. 3. so protection of habitat may be mutually beneficial.

I. Species. *Fluminicola* n. sp. 17. suggested disjunct pebblesnail

II. FEMAT Rating. 25-30-25-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in the lower portions of large, cold springs among water cress *Rorippa* and on cobbles and pebbles. May be photophobic.

B. Past Actions. Construction of tracks by the Southern Pacific Railroad has destroyed many spring habitats where this species could have occurred.

C. Species Range. Presently known from only three sites in the vicinity of Shasta Springs complex, which has been operated as a resort since at least the 1880s. All known sites are on private land owned by the St. Germain Foundation. However, at least an equal number of sites are expected to occur on federal land.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. The species occurs within a Tier 1 watershed. Adjacent federal lands are LSRs.

V. Cumulative Effects Assessment. Water diversions and other modifications of spring habitat associated with development of a resort and laying of railroad tracks have severely restricted suitable habitat.

VI. Summary. The rating given for this species indicates a concern about cumulative effects since the species predominately occurs on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Spring complexes along the upper Sacramento River.

B. Specific Habitats. Large, cold springs.

C. Mitigations Measures. Conduct inventories of springs and protect sites where this species occurs from further water diversions, grazing, mining, timber cutting and organic enrichment. Highly distinctive shell morphology makes visual surveys feasible.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

Basis for FEMAT Rating

- I. Species.** *Fluminicola* n. sp.18. suggested globular pebblesnail
- II. FEMAT Rating.** 40-20-20-20
- III. Modifications due to changes in Alternative 9.**
- IV. Explanation of Rating.**
 - A. Natural History.** Occurs in small, cold springs on stones and wood in shaded areas. May be photophobic.
 - B. Past Actions.** Burney fire of 1992 destroyed many springs where suitable habitat existed. Salvage logging in the aftermath of the fire has also impacted some sites.
 - C. Species Range.** Known from four sites in the upper Sacramento and Pit Rivers, Shasta Co., CA.
 - D. Non-habitat Factors.**
 - E. Inadequate Information.**
 - F. Features of the Alternative.** The species occurs within a Tier 1 watershed. Adjacent federal lands are LSRs.
- V. Cumulative Effects Assessment.** Two sites are on federal land and two are on private.
- VI. Summary.** The rating reflects uncertainty regarding the persistence of habitat supporting the species on nonfederal land and management of habitat on federal land. Riparian reserves should provide good protection on federal land and improve the rating significantly.
- VII. Mitigation.** Mitigation is possible.
 - A. Geographic Extent.** Upper Sacramento and Pit Rivers.
 - B. Specific Habitats.** Small, shaded, cold springs.
 - C. Mitigations Measures.** Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.
 - D. Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that

appropriate sites will be identified and protected for this species. The combination of these actions should ensure that this species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

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- I. Species. *Fluminicola* n. sp. 19. suggested Umbilicate pebblesnail
 - II. FEMAT Rating. 30-20-30-20
 - III. Modifications due to changes in Alternative 9.
 - IV. Explanation of Rating
 - A. Natural History. Occurs among water cress *Rorippa* and brooklime *Veronica* beds and on sand-gravel substrates in a large cold spring pool and adjacent spring runs. Appears to be a perolithon and periphyton grazer.
 - B. Past Actions.
 - C. Species Range. Only known from a single cold spring near Hat Creek in the Pit River drainage in Lassen National Forest. Suspected to also occur in Lost Creek, but not yet verified.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative. The only known site is in Lassen National Forest outside the range of the northern spotted owl.
 - V. Cumulative Effects Assessment. Small-scale hydropower developments by Pacific Gas and Electric may alter the water table and effect surface discharge in the area. Hat Creek is generally in good shape except for the local area which receives heavy use by the public resulting in localized pollution from sewage.
 - VI. Summary. Since this species is only known or suspected to occur outside the planning area, it is difficult to assess how implementation of option 9 will influence its distribution. If it does occur in the planning area the riparian reserves should provide good protection.
 - VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent. Hat Creek in Lassen National Forest.
 - B. Specific Habitats. Large spring pools and associated runs.
 - C. Mitigations Measures. Conduct inventories of springs and protect sites where this

species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Fluminicola* n. sp. 20. suggested Lost Creek pebblesnail

II. FEMAT Rating. 30-20-30-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating

A. Natural History. Occurs in cold, swift-flowing water in a large springfed creek, generally near shore, on sand-cobble substrate, aquatic macrophytes and the submerged portions of emergent vegetation like water cress *Rorippa* and water hemlock *Cicuta*.

B. Past Actions.

C. Species Range. Only known from two sites in Lost Creek, Lassen National Forest, Shasta Co., CA.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. The only known sites are in Lassen National Forest outside the range of the northern spotted owl.

V. Cumulative Effects Assessment. The creek has been modified for small-scale hydropower development by Pacific Gas & Electric which may alter the water table and effect surface discharge in the area. There are private inholdings in the drainage also. The Lost Creek site is a relatively recent lava flow restricting the water table to within 10 feet of the surface. This condition makes the area extremely susceptible to drying when vegetation is removed.

VI. Summary. Since this species is only known or suspected to occur outside the planning area, it is difficult to assess how implementation of option 9 will influence its distribution. If it does occur in the planning area the riparian reserves should provide good protection.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. The only known locality is Lost Creek in Lassen National Forest.

B. Specific Habitats. Occurs in cold, swift-flowing large spring-fed creek.

C. Mitigations Measures. Conduct inventories of springs and protect sites where this species occurs from water diversions, grazing, mining, timber cutting and organic enrichment.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Fluminicola seminalis* nugget pebblesnail

II. FEMAT Rating. 30-25-25-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating

A. Natural History. Occurs in rivers and large springs.

B. Past Actions.

C. Species Range. Historically, occurred in the Sacramento, McCloud and Pit Rivers. Recent events like construction of dams, the spill of the herbicide metam sodium (Vapam) in 1991, and the Burney fire of 1992 and subsequent salvage logging have all caused significant impacts to the population. The species is now about 95% extirpated from its former range in the Sacramento River.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Pacific Gas & Electric dams have destroyed habitat and stressed populations. Upper Sacramento River immediately along the river is mostly private land.

VI. Summary. Rating reflects recent loss of most of the population due to habitat degradation and a chemical spill, and occurrence on nonfederal land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Sporadic, in the Sacramento and Pit Rivers, Shasta National Forest.

B. Specific Habitats. Occurs in rivers and large springs.

C. Mitigations Measures. Conduct inventories to establish locations of populations. Transplant individuals from the Pit River to the Sacramento River.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with *Lanx patelloides*, so actions directed at this species will be mutually beneficial.

I. Species. *Helisoma (Carinifex) newberryi newberryi* Great Basin rams-horn

II. FEMAT Rating. 40-20-20-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in large lakes and slow rivers, including spring sources and spring fed creeks. Snails characteristically burrow into soft mud that is well oxygenated. Very sensitive to low dissolved oxygen.

B. Past Actions.

C. Species Range. Historically, known from 14 sites in w. WY, sw OR, UT, ne and e CA. Many of these populations have been extirpated. Surviving sites are located in the Winema and Lassen National Forests, Upper Klamath National Wildlife Refuge and vicinity of Fall River Mills, CA. Recent drying of Agency Lake resulted in loss of the population there.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Believed to occur within or near the LSR on the west side of Upper Klamath Lake. Known to occur at one site in the matrix.

V. Cumulative Effects Assessment. Mostly occurs on federal land with some populations on private land (e.g. Rising River and Fall River Mills).

VI. Summary. Rating reflects recent extirpation of many populations. The species appears to be increasingly restricted to federal lands.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Upper Klamath Lake, Winema and Lassen National Forests.

B. Specific Habitats. Under the surface of soft, well oxygenated mud.

C. Mitigations Measures. Conduct inventories of springs and lakes having suitable habitat (upwelling, well oxygenated, cold water in muddy substrates) and protect sites where this species occurs from disturbance and organic enrichment. Mitigation for sucker species such as adding spawning gravels may harm this species by smothering habitat where it exists.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with *Pisidium ultramontanum*, *Lanx klamathensis* and several other endemic molluscs, so actions directed at this species will be mutually beneficial to all.

I. Species. *Juga (Calibasis) acutifilosa* scalloped juga

II. FEMAT Rating. 40-15-15-30

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Local endemic. Occurs in large, cold springs with exceptionally good water quality, and their outflows on gravel-boulder substrates.

B. Past Actions. Species has been impacted by lowered water tables, spring diversions and livestock that trample and pollute spring habitats.

C. Species Range. Known from six sites. Only one site in OR, tributaries of Jenny Creek, Jackson Co., OR. on BLM and private (Weyerhaeuser) lands. Five sites in CA in Modoc, Siskiyou, Shasta and Lassen Cos. Mostly on federal lands (i.e. Modoc and Lassen National Forests). Also on CA. state land (i.e. Ahjumawi Lava Springs State Park).

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Known localities are within a LSR and Tier 1 watershed.

- V. **Cumulative Effects Assessment.** Diversions to the municipal water supply for Yreka, CA. and some grazing impacts. Mainly on federal lands (see above).
- VI. **Summary.** This species should receive substantial protection from riparian reserves. Recent habitat degradation contributed to the rating which could be improved considerably by proper implementation of option 9.
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.**
- B. **Specific Habitats.**
- C. **Mitigations Measures.** Conduct inventories of springs and seeps, and protect sites where this species occurs from water diversions, grazing, mining, timber cutting, and organic enrichment.
- D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with endemic *Fluminicola* spp. and a *Lyogyrus* sp. so several species may benefit from protection of associated habitat.
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I. **Species.** *Juga (Calibasis) occata* topaz juga

II. **FEMAT Rating.** 40-20-15-25

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Restricted to swift, unpolluted, well-oxygenated areas in large streams and rivers, generally at low elevations. Very intolerant of sedimentation.

B. **Past Actions.**

C. **Species Range.** Historically, was probably widely distributed in Sacramento and Pit Rivers. Currently, mainly restricted to the lower Pit River with no records from the Sacramento River in this century. Placer mining severely disturbed habitats and was a major reason for decline in the Sacramento River. Still survives in Shasta National Forest, Shasta Co., CA.

D. **Non-habitat Factors.** Cantara toxic chemical spill of 1991 may have further effected this species since it was not found in surveys of the area after the spill.

E. Inadequate Information.

F. Features of the Alternative. Localities are poorly defined for this species, however it appears that it occurs within a Tier 1 watershed. Adjacent federal lands are LSRs.

V. Cumulative Effects Assessment. Mainly on federal land, some private along the Pit and Sacramento Rivers.

VI. Summary. The rating is an indication of the recent extirpations that this species has suffered, uncertainty about actual distribution and cumulative effects.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Still survives in the lower Pit River, Shasta Co., CA.

B. Specific Habitats. Occurs in large streams and rivers.

C. Mitigations Measures. Conduct inventories to better establish distribution. Occurs in a LSR where riparian buffers will afford good protection. Control water diversions and grazing where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. 3) Co-occurs with *Lanx patelloides* and other rare molluscs so several species may benefit from protection of associated habitat.

I. Species. *Juga (Juga) hemphilli dallesensis* Dalles juga

II. FEMAT Rating. 40-10-30-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in large, shaded springs and small to medium-sized creeks, always at low elevations on stable gravel substrates in fast-flowing, unpolluted, highly-oxygenated, cold water.

B. Past Actions.

C. Species Range. Still survives at type locality in Mill Creek, Wasco Co., OR. There are a few isolated populations in the central and eastern Columbia Gorge from Hood River to the Dalles in OR and WA. Hood River and Wasco Cos., OR and Skamania Co., WA. Mt. Hood and Gifford-Pinchot National Forests and Columbia Gorge

National Scenic Area.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Apparently one site is located in or near a LSR.

V. Cumulative Effects Assessment. Of the nine known sites, two are in National Forests and seven on private lands in Columbia Gorge N.S.A.

VI. Summary. The rating reflects uncertainty about actions taken under option 9 and present distribution which appears to be increasingly restricted.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Columbia Gorge.

B. Specific Habitats. Large springs and small to medium-sized creeks.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions and grazing where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and main well distributed within its natural range.

I. Species. *Juga (Juga) hemphilli hemphilli* barren juga

II. FEMAT Rating. 40-10-30-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Large springs and small to medium-sized creeks, generally at low elevations. Found only in low-gradient, highly oxygenated, unpolluted, cold-water streams with stable substrate.

B. Past Actions.

C. Species Range. Historically, found at west end of Columbia Gorge, west of the

Willamette River at a few isolated sites. Still survives in isolated populations in mostly urban areas in Clark and Skamania Cos., WA and Multnomah Co., OR. in Columbia Gorge National Scenic Area and Mt. Hood National Forest. Recently known from a total of eight sites.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. LSRs adjacent to Columbia River may contain isolated populations.

V. Cumulative Effects Assessment. Mainly on federal land with some sites on private land in urban areas.

VI. Summary. Rating reflects increasingly fragmented historical distribution, lack of comprehensive inventories and occurrence of many sites in urban areas with private ownership.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Columbia Gorge

B. Specific Habitats. Large springs and small to medium-sized creeks.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Juga (Juga) hemphilli* n. subsp. 1. no common name

II. FEMAT Rating. 40-10-30-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Small to medium-sized low-gradient streams and large springs, generally on stable gravel substrates, but also mud. Requires cold, unpolluted, fast-flowing, well-oxygenated water.

B. Past Actions.

C. Species Range. Occurs in western Columbia gorge, west of the Willamette River and in the vicinity of Washougal, WA. Sites are in Clark Co., WA. and Multnomah Co., OR. in the Columbia River Gorge National Scenic Area.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All known sites are on private land.

VI. Summary. Since all known localities are on private land it is difficult to determine how implementation of Alternative 9 will effect this species. The relatively poor rating given to this species is an indication of the extensive loss loss of suitable habitat in the Columbia Gorge.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Western Columbia Gorge.

B. Specific Habitats. Large springs and small to medium-sized streams.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Juga (Juga)* n. sp. 1. brown juga

II. FEMAT Rating. 40-10-30-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating

A. Natural History. Occurs in small streams and springs with cold, fast-flowing, well-oxygenated water, on shaded gravel substrates.

B. Past Actions.

C. Species Range. Historically, uncertain distribution, probably the western two-thirds of Columbia Gorge. Currently isolated populations exist mainly on WA side, Skamania Co., but also Multnomah and Hood River Cos., OR. Mt. Hood National Forest. Known from eight sites.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. May occur in LSRs adjacent to Columbia River.

V. Cumulative Effects Assessment. Most sites are on private land.

VI. Summary. Rating is based on limited information and concerns about concentration of most known sites on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Western Columbia Gorge.

B. Specific Habitats. Small streams and springs.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Juga (Juga)* n. sp. 3. tall juga

II. FEMAT Rating. 40-10-30-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in small to medium-sized, cold, well-oxygenated, unpolluted, low-elevation streams, equally on mud or gravel substrates.

B. Past Actions.

C. Species Range. Historical distribution uncertain, probably western Columbia Gorge. Currently confined to a few creeks in the Mt. Hood National Forest and Columbia Gorge National Scenic Area, Multnomah and Hood River Cos. Currently known from six sites.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. May occur in LSRs adjacent to Columbia River.

V. Cumulative Effects Assessment. Even mixture of federal and private lands.

VI. Summary. Rating is based on fairly limited information and reflects concerns about impacts to suitable habitats on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Western Columbia Gorge.

B. Specific Habitats. Small to medium-sized, cold streams.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Juga (Oreobasis) chacei* Chace juga

II. FEMAT Rating. 40-25-25-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in small to medium-sized, cold, well-oxygenated, unpolluted, low to mid-elevation streams, on gravel substrates. Not known from springs.

B. Past Actions.

C. **Species Range.** Smith River drainage and a few surrounding creeks, all in Del Norte Co., CA. Known from about 18 sites.

D. **Non-habitat Factors.**

E. **Inadequate Information.**

F. **Features of the Alternative.** Known localities appear to be concentrated in LSRs and Tier 1 watersheds, with some potential sites on matrix lands.

V. **Cumulative Effects Assessment.** Most sites are on federal lands in Six Rivers National Forest.

VI. **Summary.** The rating reflects a historical trend towards range fragmentation and restriction to refugia and concerns about riparian protection in LSRs.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Smith River and associated tributaries in n. CA.

B. **Specific Habitats.** Small perennial streams with excellent water quality.

C. **Mitigations Measures.** Conduct inventories to better establish distribution. Control water diversions and organic pollution where the species occurs. Riparian reserves should provide good protection.

D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. **Species.** *Juga (Oreobasis)* n. sp. 1. no common name

II. **FEMAT Rating.** 40-20-20-20

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Occurs in small to medium-sized large springs, and spring-fed streams in cold, clear, well-oxygenated, unpolluted water. Can occur on both mud and gravel substrates. Appears to prefer shaded sites.

B. **Past Actions.**

C. Species Range. Historically, occurred in central and eastern Columbia Gorge. Currently uncommon, known from six sites from about Carson to mouth of John Day River in WA only, Skamania and Klickitat Cos.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Known localities are on the periphery of the planning area. LSRs adjacent to Columbia River may contain isolated populations.

V. Cumulative Effects Assessment. Most sites are on private lands associated with Columbia River Gorge National Scenic Area.

VI. Summary. Rating reflects the rarity of this species and its occurrence on private land. Riparian reserves should provide good protection where the species occurs on federal land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Central and eastern Columbia Gorge.

B. Specific Habitats. Occurs in springs of all sizes and spring-fed streams.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Juga (Oreobasis)* n. sp. 2. no common name

II. FEMAT Rating. 40-20-20-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Restricted to springs in small drainages associated with the Columbia River at low elevations. Prefers gravel substrate and unpolluted water.

B. Past Actions.

- C. **Species Range.** Central and eastern Columbia Gorge on OR side only in Hood River and Wasco Cos., including sites in Mt. Hood National Forest. Known from a total of eight sites.
- D. **Non-habitat Factors.**
- E. **Inadequate Information.**
- F. **Features of the Alternative.** Probably occurs in LSR on south side of Columbia Gorge.
- V. **Cumulative Effects Assessment.** Primarily occurs on private land, some sites are in Mt. Hood National Forest.
- VI. **Summary.** The rating reflects rarity of this species, its occurrence on private land and concerns about management of riparian habitat on federal lands. Riparian reserves should provide good protection where the species occurs on federal land.
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.** Central and eastern Columbia Gorge on the Oregon side only.
- B. **Specific Habitats.** Restricted to springs.
- C. **Mitigations Measures.** Conduct inventories of springs to better establish distribution. Control water diversions and organic pollution where the species occurs.
- D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. **Species.** *Juga (Oreobasis) n. sp. 3.* no common name

II. **FEMAT Rating.** 25-30-25-20

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Occurs in large, cold, shaded springs and spring runs on sand-cobble substrates.

B. **Past Actions.**

C. Species Range. Very rare, known from only four sites along upper Sacramento River, Shasta Co., CA.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All sites are on private land, but near Shasta National Forest.

VI. Summary. The rating expresses both the rarity of this species and its occurrence on private land.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Upper Sacramento River.

B. Specific Habitats. Occurs in large, shaded, cold springs.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions, grazing and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and significantly improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species: The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Juga (Oreobasis) orickensis* redwood juga

II. FEMAT Rating. 40-40-10-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in small, spring-fed perennial rivulets to creeks on gravel substrates, always in clear, cold, unpolluted water at high to low elevations.

B. Past Actions.

C. Species Range. Historically, occurred in coastal streams in s. Curry Co., OR and Del Norte, Humboldt, and w. Trinity Cos., CA. Currently known from Siskiyou, Six

Rivers and Trinity National Forests and Redwood National Park.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Localities are mainly in LSRs and Tier 1 watersheds, possibly with a few sites in matrix.

V. Cumulative Effects Assessment. Mostly occurs on federal lands in Redwood National Park.

VI. Summary. Application of riparian reserves should provide good protection for this species and provide even greater certainty of maintaining well-distributed populations.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Coastal streams of sw OR and nw CA.

B. Specific Habitats. Small, spring-fed streams.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions, substrate disturbance and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. Species. *Lanx alta* highcap lanx

II. FEMAT Rating. 40-15-30-15

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in large rivers and major tributaries having excellent water quality on stable boulder or cobble substrates in fast currents. A perolithon feeder. The species is very sensitive to sediment and requires well-oxygenated water to survive. Semelparous-one year life cycle with complete population turn-over annually.

B. Past Actions.

C. Species Range. Historically, known from the Rogue, Klamath, Smith and Trinity Rivers in sw OR and nw CA. Josephine, Curry and Jackson Cos. OR and Siskiyou, Del Norte and Humboldt Cos., CA. May be extirpated from many sites on Rogue River. Range is becoming fragmented.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative. Localities are mainly in LSRs and Tier 1 watersheds.

V. Cumulative Effects Assessment. Mixture of federal (Winema, Klamath, Six Rivers and Trinity National Forests) and private.

VI. Summary. There is good evidence that the range for this species is becoming fragmented which largely accounts for the rating. Occurrence of this species on nonfederal land also contributed to the rating.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Northwestern CA and southwestern OR.

B. Specific Habitats. Large rivers and major tributaries on large substrates in fast currents.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions, sedimentation, substrate disturbance and organic pollution where the species occurs. Protect riparian corridors.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

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- I. Species.** *Lanx klamathensis* scale lanx
 - II. FEMAT Rating.** 40-20-20-20
 - III. Modifications due to changes in Alternative 9.**
 - IV. Explanation of Rating.**

A. **Natural History.** A relict species restricted to large, spring-fed lakes and streams and limnocrane (lake upwelling) springs, on boulders and cobbles in flowing, oxygenated, high-quality water. An obligate perolithon grazer.

B. **Past Actions.**

C. **Species Range.** Historically, in Klamath Lake Basin, Klamath Co. OR and Siskiyou Co., CA. Severely restricted distribution recently. Survives in a few spring-buffered sites in Upper Klamath Lake area, including Link River and in Winema National Forest and Upper Klamath National Wildlife Refuge. Tule Lake population may be extinct. May occur in Rogue River National Forest.

D. **Non-habitat Factors.**

E. **Inadequate Information.**

F. **Features of the Alternative.** Populations probably occur in the LSR to west of Upper Klamath Lake.

V. **Cumulative Effects Assessment.** Mostly on federal with some sites on private land.

VI. **Summary.** Eutrophication of Klamath Lake and destruction of many spring habitats in the vicinity of the lake have resulted in range fragmentation and extirpation of many populations which largely accounts for rating.

VII. **Mitigation.** Mitigation is possible.

A. **Geographic Extent.** Klamath Lake basin.

B. **Specific Habitats.** Large spring-fed lakes and streams.

C. **Mitigations Measures.** Conduct inventories to better establish distribution. Control water diversions, sedimentation, substrate disturbance and organic pollution where the species occurs. Mitigation for sucker species such as adding spawning gravels may harm this species by smothering habitat where it exists.

D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

I. **Species.** *Lanx patelloides* kneecap lanx

II. FEMAT Rating. 50-20-20-10

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in large rivers and major tributaries on stable substrates in slow to moderate currents at low to mid-elevations. May also occur in large springs having excellent water quality, and rarely in spring-fed creeks. Semelparous-one-year life cycle with nearly complete population turn-over annually.

B. Past Actions.

C. Species Range. Historically, in Sacramento and Pit River systems. Largely extirpated from Sacramento River system. Still persists in Pit River system, Shasta Co., CA. In Shasta National Forest. Presently known from 12-15 sites.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Even mixture of federal and private lands.

VI. Summary. Recent restrictions in range had a major influence on the rating, with concerns about occurrences on private land also contributing.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Pit River, n. CA.

B. Specific Habitats. Large rivers and major tributaries on stable, clean substrates.

C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions, sedimentation, substrate disturbance and organic pollution where the species occurs.

D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

- I. Species. *Lanx subrotundata rotund lanx*
- II. FEMAT Rating. 50-20-20-10
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating.
 - A. Natural History. Occurs in large rivers and major tributaries on stable substrates in swift current at low to mid-elevations. Semelparous- one-year life cycle with nearly complete population turn-over annually.
 - B. Past Actions.
 - C. Species Range. Historically, in Umpqua River and its major tributaries. Apparently restricted populations developed recently due to pollution and impoundments, and impacts associated with cutting of timber.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative. Most of the Umpqua drainage is in LSR status.
- V. Cumulative Effects Assessment. Localities from a mixture of federal and private lands.
- VI. Summary. Recent destruction of habitat and fragmentation of populations influenced the rating. Concerns over cumulative impacts on nonfederal land was also a factor.
- VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent. Umpqua drainage.
 - B. Specific Habitats. Large rivers, stable clean substrates, fast currents.
 - C. Mitigations Measures. Conduct inventories to better establish distribution. Control water diversions, sedimentation, substrate disturbance and organic pollution where the species occurs. Major portion of the Umpqua River system is in LSR where riparian buffers should afford protection.
 - D. Benefits. 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed actions and remain well distributed within its natural range.

-
- I. **Species.** *Lyogyrus* n. sp. 1. Columbia dusksnail
- II. **FEMAT Rating.** 40-10-30-20
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. **Natural History.** Occurs in springs and spring outflows, from low to high elevations, in cold, pure, well oxygenated water. Prefers soft substrates and slow current velocities and springs without macrophytes, but may be found in larger springs with water cress *Rorippa* and water hemlock *Cicuta*. One year life span.
- B. **Past Actions.**
- C. **Species Range.** Historical distribution unknown. Presently known for the central and eastern portions of the Columbia Gorge.
- D. **Non-habitat Factors.**
- E. **Inadequate Information.**
- F. **Features of the Alternative.** Distribution is poorly known, but the species is known to occur in the LSR adjacent to Columbia River on the OR side.
- V. **Cumulative Effects Assessment.** Occurs on an even mixture of federal and private lands.
- VI. **Summary.** This taxon has been recently recognized and its distribution is poorly known which mainly accounts for its rating. Concerns about cumulative effects also had an influence.
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.** Central and eastern Columbia Gorge.
- B. **Specific Habitats.** Occurs in cold springs and their associated outflows.
- C. **Mitigations Measures.** Conduct inventories to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.
- D. **Benefits.** 1) Proper implementation of buffer strips will provide considerable protection for known and newly discovered sites and improve the original ratings. 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species. The combination of these actions should ensure that the species will continue to exist on federal lands due to the proposed

actions and remain well distributed within its natural range.

-
- I. Species. *Lyogyrus* n. sp. 2. Washington duskysnail
 - II. FEMAT Rating. 50-10-20-20
 - III. Modifications due to changes in Alternative 9.
 - IV. Explanation of Rating.
 - A. Natural History. Occurs in kettle lakes on the periphery of the Columbia drainage in WA. on well oxygenated mud sediments in areas with some macrophytes. Feeds on the surfaces of leached deciduous leaves.
 - B. Past Actions.
 - C. Species Range. Historically (since Pleistocene), was probably common in n. and central WA east of Cascade Mts. to the Rocky Mts., in heavily glaciated valleys. Presently known from only two lakes, one in Ferry Co. and the other in Wenatchee National Forest, Chelan Co., WA.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative.
 - V. Cumulative Effects Assessment. One site on federal land, one on private.
 - VI. Summary.
 - VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent.
 - B. Specific Habitats.
 - C. Mitigations Measures. Not found in oligotrophic lakes, will tolerate eutrophication to some degree. Application of chemical herbicides to control macrophytes will cause mortality.
 - D. Benefits.
-

I. Species. *Lyogyrus* n. sp. 3. canary duskysnail

II. FEMAT Rating. 30-20-20-30

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs on the undersides of loose but stable cobbles and boulders in a large spring associated with encrusting red algae. Appears to be photophobic. Shell length under 1 1/2 mm, body bright yellow and semitransparent.

B. Past Actions.

C. Species Range. Historical distribution unknown, probably in major spring complexes in Pit River drainage. Presently known from only two sites; one is a large spring near the boundary of Shasta National Forest and the other is a spring influenced area in the Pit River. May also occur on BLM lands and in Lassen and Shasta National Forests in the vicinity of Fall River Mills.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All sites are on private land.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories of suitable springs to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.

D. Benefits.

I. Species. *Lyogyrus* n. sp. 4. Klamath duskysnail

II. FEMAT Rating. 30-15-25-30

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. **Natural History.** Lives on undersides and sides of boulders and cobbles in Klamath Lake in areas with spring influence generally without macrophytes. Can also occur on mare's eggs (colonies of the blue-green cyanobacteria *Nostoc*).

B. **Past Actions.**

C. **Species Range.** Historically, occurred on both sides of Upper Klamath Lake, including the Link River, Klamath Co., OR. Known to survive at only four sites that are protected from effects of eutrophication by spring influx.

D. **Non-habitat Factors.**

E. **Inadequate Information.**

F. **Features of the Alternative.**

V. **Cumulative Effects Assessment.** Two sites are on private land and two are in Upper Klamath Lake National Wildlife Refuge. Possibly in Winema National Forest.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. **Geographic Extent.**

B. **Specific Habitats.**

C. **Mitigations Measures.** Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.

D. **Benefits.**

I. **Species.** *Lyogyrus* n. sp. 5. nodose duskysnail

II. **FEMAT Rating.** 30-15-25-30

III. **Modifications due to changes in Alternative 9.**

IV. **Explanation of Rating.**

A. **Natural History.** Lives on undersides and sides of boulders and cobbles in a

spring complex draining into Upper Klamath Lake and rarely in the spring-influenced outflow from the lake. Sites have water cress *Rorippa* but snails occur only on rocks. Species may be photophobic. Body lacks pigment. Shell length @ 1.5 mm, with large knobs.

B. Past Actions.

C. Species Range. Historically, occurred in Upper Klamath Lake and its major spring tributaries, Klamath Co., OR. Currently known from four sites: a spring-influenced area of west Klamath Lake, the Link River and two springs.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Two sites are on private land and two are on federal land.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.

D. Benefits.

I. Species. *Lyogyrus* n. sp. 6. Mare's egg dusksnail

II. FEMAT Rating. 30-20-25-25

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Lives on undersides of boulders and cobbles, and on mare's eggs (colonies of the blue-green cyanobacteria *Nostoc*) in Klamath Lake in areas with spring influence.

B. Past Actions.

C. Species Range. Historically, occurred in Upper Klamath Lake. Presently known from only two sites: Herriman's Spring and west end of Klamath Lake.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. One private site (Herriman's Spring), one on Winema National Forest.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs. Mitigation for sucker species such as adding spawning gravels may harm this species by smothering habitat where it exists.

D. Benefits.

I. Species. *Physella (Physella) columbiana* rotund physa

II. FEMAT Rating. 20-20-30-30

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Poorly known. A denizen of large rivers probably restricted to relatively pure, deep, well oxygenated water. Substrate preferences are unknown but appear to be gravel and cobble. Present at low elevations only.

B. Past Actions.

C. Species Range. Historical distribution poorly known, probably endemic to lower Columbia below the Dalles and up the Willamette River to Willamette Falls. May now be extinct since there are no recent records. However, suitable rocky habitat still

exists in limited areas and survival of an associated species, *Fisherola nuttalli* has recently been confirmed.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Distribution is too poorly known to estimate.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories in an attempt to locate surviving populations. Protect remaining suitable rocky habitats from further sedimentation and impoundments.

D. Benefits.

I. Species. *Pyrgulopsis archimedis*, *Archimedes pyrg*

II. FEMAT Rating. 30-20-25-25

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs in large lakes in areas with spring influence that provide protection against low dissolved oxygen and other effects of eutrophication. Prefers areas with gravel-boulder substrates and few macrophytes.

B. Past Actions.

C. Species Range. Historically, found in Upper Klamath and Tule Lakes, Klamath Co., OR. and Siskiyou Co., CA. Currently known from only four spring-influenced sites associated with Klamath Lake. The Tule Lake population is probably extinct.

D. Non-habitat Factors.

- E. Inadequate Information.
 - F. Features of the Alternative.
 - V. Cumulative Effects Assessment. Known from two sites on private land and two on federal land.
 - VI. Summary.
 - VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent.
 - B. Specific Habitats.
 - C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.
 - D. Benefits.
-

- I. Species. *Pyrgulopsis intermedia* Crooked Creek springsnail
- II. FEMAT Rating. 40-20-30-10
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating.
 - A. Natural History. Occurs primarily in large springs, but also in spring-influenced creeks and rivers on gravel-boulder substrates. Species has a one-year life cycle with breeding occurring over a four month period. This taxon may be a species complex.
 - B. Past Actions.
 - C. Species Range. Historically, occurred at the periphery of the Great Basin along what is believed to be the former course of the Snake River from sw ID, through se OR to the Pit River in ne CA. Currently known from eight scattered sites in Harney and Malheur Cos., OR and Shasta Co., CA.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative.

- V. **Cumulative Effects Assessment.** Mostly occurs on federal lands, with some sites on private land.
 - VI. **Summary.**
 - VII. **Mitigation.** Mitigation is possible.
 - A. **Geographic Extent.**
 - B. **Specific Habitats.**
 - C. **Mitigations Measures.** Conduct inventories at spring sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.
 - D. **Benefits.**
-

- I. **Species.** *Pyrgulopsis* n. sp. 1. lake pyrg
- II. **FEMAT Rating.** 30-20-25-25
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
 - A. **Natural History.** Occurs on cobbles and boulders in spring-influenced areas of Klamath Lake.
 - B. **Past Actions.**
 - C. **Species Range.** Historically, occurred in Upper Klamath Lake, Klamath Co., OR. Currently known to survive at two sites in Klamath Lake.
 - D. **Non-habitat Factors.**
 - E. **Inadequate Information.**
 - F. **Features of the Alternative.**
- V. **Cumulative Effects Assessment.** One site on federal land, one on private land.
- VI. **Summary.**
- VII. **Mitigation.** Mitigation is possible.
 - A. **Geographic Extent.**

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.

D. Benefits.

I. Species. *Vorticifex klamathensis klamathensis* suggested Klamath rams-horn

II. FEMAT Rating. 30-15-25-30

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Occurs on cobbles and boulders in flowing water in spring-influenced streams and in Klamath Lake.

B. Past Actions.

C. Species Range. Historically, known from Upper Klamath Lake and associated streams, Klamath Co., OR. Currently known from six sites on both sides of Upper Klamath Lake.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. All sites are on federal land, including Winema National Forest and Klamath Lake National Wildlife Refuge.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent.

B. Specific Habitats.

C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.

D. Benefits.

-
- I. **Species.** *Vorticifex klamathensis sinitsini* suggested Sinitsin rams-horn
- II. **FEMAT Rating.** 30-20-25-25
- III. **Modifications due to changes in Alternative 9.**
- IV. **Explanation of Rating.**
- A. **Natural History.** Occurs on cobbles and boulders in a large, cold spring, generally not in areas with macrophytes.
 - B. **Past Actions.**
 - C. **Species Range.** Known from only a single site (i.e. Barclay Springs), but likely occurs in other springs in the same region.
 - D. **Non-habitat Factors.**
 - E. **Inadequate Information.**
 - F. **Features of the Alternative.**
- V. **Cumulative Effects Assessment.** Only known occurrence is on private land, however it may also occur on adjoining federal lands.
- VI. **Summary.**
- VII. **Mitigation.** Mitigation is possible.
- A. **Geographic Extent.**
 - B. **Specific Habitats.**
 - C. **Mitigations Measures.** Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs. Recent mitigation for sucker species such as adding spawning gravels may harm this species by smothering habitat where it exists.
 - D. **Benefits.**
-

- I. Species. *Vorticifex n. sp. 1.* knobby rams-horn
- II. FEMAT Rating. 30-20-20-30
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating.
 - A. Natural History. Occurs in a very large, pristine spring complex and its outflow on rocky substrates, in very cold, clear, swift and well-oxygenated water.
 - B. Past Actions.
 - C. Species Range. Historically, appears to have been confined to Pit River in Shasta, Modoc and Lassen Cos., CA. Currently known from only three sites in Shasta Co.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative.
- V. Cumulative Effects Assessment. All known sites are on private land. Populations may also occur in Shasta National Forest, on lands administered by Lassen National Forest, and on state-owned lands near Fall River Mills.
- VI. Summary.
- VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent.
 - B. Specific Habitats.
 - C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.
 - D. Benefits.

-
- I. Species. *Vorticifex neritoides* nerite rams-horn
 - II. FEMAT Rating. 20-20-30-30
 - III. Modifications due to changes in Alternative 9.
 - IV. Explanation of Rating.

A. Natural History. Poorly known, probably prefers unpolluted, rocky areas with fairly swift currents and well-oxygenated water in unimpounded areas.

B. Past Actions.

C. Species Range. Historically, collected from the lower Columbia River below the Dalles. Probably extinct at the type locality, but found at one site in 1988.

D. Non-habitat Factors.

E. Inadequate Information.

F. Features of the Alternative.

V. Cumulative Effects Assessment. Recent collection only on private land.

VI. Summary.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent.

B. Specific Habitats.

C. Mitigation Measures. Conduct inventories in an attempt to locate surviving populations. Protect remaining suitable rocky habitats from further sedimentation and impoundments.

D. Benefits.

I. Species. *Anodonta californiensis* California floater

II. FEMAT Rating. 30-25-25-20

III. Modifications due to changes in Alternative 9:

IV. Explanation of Rating.

A. Natural History. Occurs in large rivers, lakes and perennial streams. The lifespan of this filter feeder is likely greater than 20 years.

B. Past Actions. Habitat has been severely impacted by previous actions resulting in extirpation from significant portions of the historic range. Reduction in host fish populations that disperse larval clams has also adversely impacted this species.

C. Species Range. Historically, was widely distributed in WY, NV, UT, AZ, northern 2/3 CA, OR, WA. Now extinct in UT, NV. Current range is also becoming fragmented due to eradication of many populations. Still survives in the Fall and Pit Rivers, Shasta Co., CA, northeastern WA., Deschutes River, OR. and perhaps in the Columbia River near the Dalles.

D. Non-habitat Factors.

E. Inadequate Information. The identity of host fish species has not been firmly established, but likely candidates include salmonids and dace.

F. Features of the Alternative. Although present distribution is poorly defined, it appears that some of the habitat along the Pit River is in LSRs or administrative withdrawals.

V. Cumulative Effects Assessment. Hydropower development, ground water pollution, diversions, grazing and siltation. Many populations probably occur on nonfederal lands, so cumulative effects are a major concern for this species. Cumulative effects were adequately taken into consideration in rating this species.

VI. Summary. The distribution of this species has been severely restricted due to water pollution, hydropower development, siltation and declining host fish populations. Cumulative impacts from activities on nonfederal lands suggests that this species may be restricted to federal lands in the future. Some protection will probably be afforded by LSRs and Administrative withdrawals along the Pit River. The species is federally listed as category 2.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Fall and Pit Rivers, Shasta Co., CA and perhaps in the Columbia River near the Dalles.

B. Specific Habitats. Large rivers.

C. Mitigation Measures.- 1) Conduct inventories to better establish distribution, 2) avoid instream enhancement that may have negative impacts (i.e. activities that cause major disruption of or increased siltation on suitable gravel habitats), and 3) protect host fish populations.

D. Benefits. 1) Proper implementation of buffer strips should provide some protection for this species, 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

I. Species. *Anodonta wahlametensis* suggested Willamette floater

II. FEMAT Rating. 30-25-25-20

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Primarily a large stream or river form, occurs in coarse sediments. The life span of this filter feeder is greater than 20 years.

B. Past Actions. Habitat has been severely impacted by previous actions resulting in extirpation from significant portions of the historic range. Reduction in host fish populations that disperse larval clams has also adversely impacted this species.

C. Species Range. Historically, had a restricted range: Columbia River from its mouth to the Dalles, lower Willamette River and northern California in Sacramento, Pit and upper Klamath Rivers. Mostly extinct in former range. Still survives in very localized populations in the Pit River and lower Columbia River in OR and WA.

D. Non-habitat Factors.

E. Inadequate Information. The identity of host fish species has not been firmly established, but likely candidates include salmonids and dace.

F. Features of the Alternative. Although present distribution is poorly defined, it appears that some of the habitat along the Pit River is in LSRs or administrative withdrawals.

V. Cumulative Effects Assessment. Hydropower development, ground water pollution, diversions, grazing and siltation. Many populations probably occur on nonfederal lands, so cumulative effects are a major concern for this species.

VI. Summary. The distribution of this species has been severely restricted due to water pollution, hydropower development, siltation and declining hostfish populations. Cumulative impacts from activities on nonfederal lands suggests that this species may be restricted to federal lands in the future. Some protection will probably be afforded by LSRs and Administrative withdrawals along the Pit River.

VII. Mitigation. Mitigation is possible.

A. Geographic Extent. Primarily a large stream or river form, occurs in coarse sediments.

B. Specific Habitats. Occurs in coarse sands and gravel.

C. Mitigation Measures. 1) Conduct inventories to better establish distribution, 2) avoid instream enhancement that may have negative impacts (i.e. activities that cause major disruption of or increased siltation on suitable gravel habitats), and 3) protect host fish populations.

D. Benefits. 1) Proper implementation of buffer strips should provide some

protection for this species, 2) Inventories would provide a much higher level of certainty that appropriate sites will be identified and protected for this species.

- I. Species. *Pisidium (Cyclocalyx) ultramontanum* montane peaclam
- II. FEMAT Rating. 40-20-30-10
- III. Modifications due to changes in Alternative 9.
- IV. Explanation of Rating.
 - A. Natural History. Generally found in sand-gravel substrates in spring-influenced streams and lakes. Characteristically in areas with high mollusc diversity.
 - B. Past Actions.
 - C. Species Range. Historically, occurred on the periphery of the Great Basin in sw ID and OR to Klamath and Pit Rivers and some larger lakes (i.e. Upper Klamath Lake, Eagle Lake, Tule Lake and possibly Lower Klamath Lake). Presently many populations are extinct and the species is known from only eight sites in Upper Klamath Lake, middle Pit River and Eagle Lake. Populations may also survive in Shasta National Forest, although none are known from old sites.
 - D. Non-habitat Factors.
 - E. Inadequate Information.
 - F. Features of the Alternative.
- V. Cumulative Effects Assessment. Four sites are on federal land and four are on private land.
- VI. Summary. The species is federally listed in category 2.
- VII. Mitigation. Mitigation is possible.
 - A. Geographic Extent.
 - B. Specific Habitats.
 - C. Mitigations Measures. Conduct inventories at sites with suitable habitat to better establish distribution. Control water diversions, sedimentation and organic pollution where the species occurs.
 - D. Benefits.

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Amphibians

I. Species. Black Salamander

II. FEMAT Rating. 75-15-10-0

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of Rating.

A. Natural History. Occurs in small isolated pockets under rocks, surface litter, bark, and coarse woody debris. Associated with moister conditions, often near streams. Can occur in open forested habitats. Elevation generally < 5,000 feet. Headwater streams may be important refugia.

B. Past Actions. Loss of headwater habitat on cutover land has reduced distribution to more localized populations.

C. Species Range. Only about 27 percent of range is on federal lands. Of the federal portion, 39 percent falls within Congressionally Reserved Areas or Late-Successional Reserves.

D. Non-habitat Factors. Species may be sensitive to global warming.

E. Inadequate Information. Habitat requirements are poorly understood. Only 1 of 4 panelists was knowledgeable enough to rate the species.

F. Features of the Alternative. Distribution and size of riparian habitat is the key habitat factor.

V. Cumulative Effects Assessment. Management of streamside habitat on nonfederal lands is an important consideration. Where smaller streams cross nonfederal and federal lands, nonfederal practices may influence downstream populations on federal lands. Effects of other factors, such as global warming, may be important but cannot be predicted.

VI. Summary. Rating reflects some uncertainty about the species' primary habitat associations and its naturally patchy distribution. Because Alternatives 1 and 4 (with Riparian Reserve Scenario 1 widths) had higher ratings for Outcome A, smaller Riparian Reserve widths on intermittent streams outside of Tier 1 Key Watersheds was the key reason for lower ratings.

VII. Mitigation. As a result of the analysis described in parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Rangewide.

B. Specific Habitats. Riparian habitat along intermittent streams, especially those areas containing talus.

C. Mitigation Measures. Survey streamside habitat along intermittent stream segments outside of Tier 1 Key Watersheds prior to disturbing activity. Where species occurs, designate and protect (through application of Aquatic Conservation Strategy standards and guidelines) Riparian Reserves of at least 1 site potential tree height or 100 feet along each side of stream.

D. Benefits. Riparian Reserve Scenario 1 along occupied sites will increase ratings to level comparable to Alternatives 1 or 4.

I. Species. Cascade Torrent Salamander

II. FEMAT Rating. 70-24-5-1

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of Rating.

A. Natural History. Occurs in or near cold, clear streams and seeps especially in association with talus, small rocks, and gravel.

B. Past Actions. Loss of headwater stream habitat may have caused local loss of populations.

C. Species Range. Species is narrowly endemic within range of northern spotted owl. About 49 percent of species potential range is on federal lands. About 49 percent of its federal range is contained within Late-Successional Reserves and Congressionally Reserved Areas. Species has a patchy distribution reflecting occurrence of primary habitat.

D. Non-habitat Factors. Species may be sensitive to global warming.

E. Inadequate Information. Species distribution is poorly known.

F. Features of the Alternative. Key feature is riparian habitat protection through width of riparian reserves along intermittent streams. Prevention of road building and other activities that increase sedimentation are key factors.

V. Cumulative Effects Assessment. About half of the species' distribution is nonfederal. Where intermittent and small streams cross boundaries, there may be impacts on federal portion. In addition, small hydroelectric projects and water diversions will be deleterious if substrate is disturbed or water levels fluctuate.

VI. Summary. Rating in Outcome A partially reflects patchy distribution of species, but also reflects concern for riparian reserve width along intermittent streams. Outcome D resulted from 1 panelist--3 others gave no likelihood of D. Rating is based on assumption that species

will be surveyed through watershed analysis and that occupied sites will be protected following Riparian Reserve Scenario 1 within Tier 1 Key Watersheds. Lower ratings would result if this is not done.

VII. Mitigation. As a result of the analysis described in Parts I and II, possible mitigation measures were identified for this species and are described below

A. Geographic Extent. Rangewide

B. Specific Habitats. Cold, clear headwater and small streams and seeps especially in association with talus.

C. Mitigation Measures. Conduct surveys for the species using standard stream-survey protocol. Designate occupied stream segments. Within occupied segments outside of Tier 1 Key Watersheds, manage to maintain Riparian Reserve Scenario 1.

D. Benefits. Application of mitigation will result in ratings comparable to those of Alternatives 1 and 4.

I. Species. Columbia Torrent Salamander

II. FEMAT Rating. 3-21-54-23

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating.

A. Natural History. Occurs in or near cold, clear streams and seeps, especially in association with talus, small rocks, and gravel.

B. Past Actions. Loss of riparian habitat along headwater streams may have caused local loss of populations.

C. Species Range. Species is endemic to range of northern spotted owl; only about 3 percent of its range is on federal lands. Of the federal land, 57 percent is in Late-Successional Reserves or Congressionally Reserved Areas. About 40 percent of the range on federal land is in the North Coast Adaptive Management Area. About 80 percent of this AMA is classified as Late-Successional Reserve to protect marbled murrelet habitat.

D. Non-habitat Factors. Species may be sensitive to global warming.

E. Inadequate Information. Species distribution is poorly known.

F. Features of the Alternative. Riparian habitat protection is key, especially width of

riparian reserve along intermittent streams. Prevention of road building and other activities that increase sedimentation are key factors.

V. Cumulative Effects Assessment. Primary risk to this species is management practices on nonfederal lands (97 percent of range). Other factors (see above) may exacerbate this risk over the long term.

VI. Summary. Rating reflects species naturally patchy distribution, and its distribution on nonfederal lands. Risk of extirpation from federal lands is high due to demographic uncertainty and isolation of small remaining populations on federal lands. Ratings are similar for all Alternatives.

VII. Mitigation. No measure can significantly increase ratings.

I. Species. Cope's Giant Salamander

II. FEMAT Rating. 79-20-1-0

III. Modifications due to changes in Alternative 9. None.

IV. Explanation of Rating.

A. Natural History. Species is mostly neotenic and inhabits small rocky creeks and seeps and requires cool water temperatures (usually < 14° C). Individuals use cover under stones, bark or other surface debris near water's edge.

B. Past Actions. Past harvest along headwater streams have reduced population size.

C. Species Range. Species is endemic to range of the northern spotted owl. About 44 percent of its range is on federal lands; of this, about 68 percent falls within Late-successional Reserves or Congressionally Reserved Areas. The species is distributed into 3 major population clusters; the coastal subpopulation occurs exclusively on nonfederal lands.

D. Non-habitat Factors. Species may be sensitive to global warming.

E. Inadequate Information.

F. Features of the Alternative. Riparian habitat protection along intermittent streams is the key factor in evaluating risk.

V. Cumulative Effects Assessment. Overall viability will be influenced by riparian habitat conditions on nonfederal lands and by long term trends in global warming. If nonfederal habitat protection is not sufficient to maintain cool water temperatures and adequate cover on intermittent streams, significant portions of the population may be lost.

VI. Summary. Rating in Outcome B reflects patchy distribution of populations and concern about the adequacy of riparian habitat protection along intermittent streams outside of Tier 1 Key Watersheds. The original Assessment Team Ratings in the FEMAT Report assume successful designation and protection of occupied sites within key watersheds through watershed analysis procedures.

VII. Mitigation. As a result of the analysis described in parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Mitigation should focus on the populations of northern Oregon where subpopulations are less protected within reserves (see species distribution map).

B. Specific Habitats. Cold, clear headwater and smaller streams and seeps

C. Mitigation Measures. Conduct surveys for the species using stream-survey protocol. Designate occupied stream segments. Within occupied segments outside of Tier 1 Key Watersheds, manage to maintain Riparian Reserve Scenario 1.

D. Benefits. Application of mitigation will result in ratings comparable to those of Alternatives 1 and 4.

I. Species. Southern Torrent Salamander

II. FEMAT Rating. 74-23-3-1

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of Rating.

A. Natural History. Occurs in or near cold, clear streams and seeps especially in association with small rocks and gravel < 3,500 feet elevation. Canopy closure is high at occupied sites; species is sensitive to sedimentation.

B. Past Actions. Harvest along headwater streams has caused local reduction of populations.

C. Species Range. Species is endemic to range of northern spotted owl. About 37 percent of its range is on federal lands; of this, about 70 percent is designated as Late-Successional Reserve or Congressionally Reserved Areas under Alternative 9. Very little of the species' range in California is on federal lands (< 20 percent).

D. Non-habitat Factors. Species may be sensitive to global warming.

E. Inadequate Information. Species distribution is not well known.

F. Features of the Alternative. Riparian reserve width along intermittent streams to maintain cool water temperature and foraging habitat for adults. Prevention of road building and other activities that increase sedimentation are key factors.

V. Cumulative Effects Assessment. Effects of non-habitat factors are unknown. Loss of habitat on nonfederal lands will reduce population size, especially in California where relatively little of the range is federal. Overall population rating would be lower than that expressed for habitat on the federal lands.

VI. Summary. Rating for Outcome A reflects the species' naturally patchy distribution as well as likelihood of further loss of local populations through harvest of riparian habitat along headwater streams outside of Tier 1 Key Watersheds. Risk of extirpation rating is based on opinion of one of four panelists, and reflects long term uncertainty associated with other environmental factors outside the range of alternatives considered.

VII. Mitigation. As a result of the analysis described in Parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Rangewide

B. Specific Habitats. Cold, clear headwater streams and adjacent riparian habitat.

C. Mitigation Measures. Conduct surveys for species using stream-survey protocol. Designate occupied stream segments. Within occupied segments outside of Tier 1 Key Watersheds, maintain Riparian Reserve Scenario 1.

D. Benefits. Application of mitigation measures will result in ratings comparable to those of Alternatives 1 and 4.

I. Species. Tailed Frog

II. FEMAT Rating. 78-20-3-0

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Associated with fast-flowing permanent streams and headwaters within forested areas. Sensitive to water temperature (requires cold water) and sedimentation. Occurs up to timberline (up to 10,000 feet).

B. Past Actions. Loss of streamside habitat, increasing stream temperature, and sedimentation have likely caused local loss of populations in affected stream segments throughout range.

C. Species Range. Species is largely endemic and broadly distributed within range of the northern spotted owl. About 57 percent of its range is on federal land; of this, 65 percent is within Congressionally Reserved Areas or Late-Successional Reserves.

D. Non-habitat Factors. Very sensitive to water temperature and water quality; so global warming may cause long-term risk.

E. Inadequate Information.

F. Features of the Alternative. Provision of adequate streamside buffers to maintain cool water temperature and prevention of road building and other activities that increase sedimentation are key factors.

V. Cumulative Effects Assessment. Population viability is potentially at risk due to global warming. Conditions on nonfederal lands, especially riparian habitat protection measures, will affect population size.

VI. Summary. Rating for Outcome A reflects patchy distribution of species in relation to appropriate stream conditions, and reflect risk of potential loss of local populations outside of Tier 1 Key Watersheds.

VII. Mitigation. As a result of the analysis described in Parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Rangewide.

B. Specific Habitats. Cold, clear streams and adjacent riparian habitat.

C. Mitigation Measures. Conduct surveys for the species using standard stream-survey protocol. Designate occupied stream segments. Within occupied segments outside of Tier 1 Key Watersheds, manage to maintain Riparian Reserve Scenario 1.

D. Benefits. Application of mitigation will result in ratings comparable to those of Alternatives 1 and 4.

I. Species. Van Dyke's Salamander (Cascades)

II. FEMAT Rating. 0-20-58-23

III. **Modifications due to changes in Alternative 9.** No significant changes.

IV. **Explanation of Rating.**

A. **Natural History.** Species associated with downed wood within riparian zone in headwater streams, generally below 3,500 feet elevation. May be declining, but causes are unknown. Only 8 known localities; few in Late-Successional Reserve. Many surveys have been done but species not found in suitable habitat--habitat may not be limiting.

B. **Past Actions.** Past loss of rocky habitat due to road building and loss of streamside cover may have contributed to population decline.

C. **Species Range.** Species is endemic to range of northern spotted owl, and occurs in scattered isolated subpopulations. Current and historic distribution fits Outcome C.

D. **Non-habitat Factors.** Unknown.

E. **Inadequate Information.** Species distribution is poorly known. Population trend is not well known, but seems to be declining.

F. **Features of the Alternative.** Riparian reserve system to maintain cool, moist conditions. Standards and Guidelines for road building and mining to protect rocky sites.

V. **Cumulative Effects Assessment.** About half of range is on federal land. Effects of other environmental factors are unknown. Population is at risk and loss of localities on nonfederal land will increase this risk.

VI. **Summary.** Rating reflects species naturally patchy distribution and cannot be significantly increased through additional habitat protection. Because of possible population decline and rarity, extirpation risk is significantly high for all Alternatives.

VII. **Mitigation.** As a result of the analysis described in parts I and II, possible mitigation measures were identified for this species and are described below.

A. **Geographic Extent.** Species range within Cascades of Washington.

B. **Specific Habitats.** Streamside areas, especially rock outcrops and talus.

C. **Mitigation Measures.** Survey within species range along headwater streams. Recommend these surveys be part of watershed analysis procedures. For all localities where species is detected, delineate area on appropriate base map. Specify Riparian Reserve Scenario 1 widths (1 site-potential tree height or 100 feet). Manage to maintain coarse woody debris within reserve, and to maintain cool, moist conditions through overstory cover. Avoid ground disturbing activity in rocky habitats.

D. **Benefits.** Protection of known sites will significantly reduce risk of extirpation.

Rating in Outcome A will probably not increase significantly.

I. Species. Van Dyke's Salamander (Olympic Peninsula, Coast)

II. Original FEMAT rating. 36-48-14-3

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of rating

A. Natural History. Species associated with downed wood and rocky soils within riparian zone in headwater streams, generally below 3,500 feet elevation. Populations may be declining due to factors other than habitat. Populations occur in specific habitats, especially along headwater streams; populations are naturally patchy.

B. Past Actions. Not a primary factor in the ratings.

C. Species Range. Narrowly endemic. Ratings reflect the naturally patchy distribution of the species. For this species, the combination of Outcomes A plus B may be a better reflection of viability risk. Olympic Peninsula populations occur primarily on federal lands. Coastal subpopulation may be isolated and occurs exclusively on nonfederal lands. For this reason, ratings for this portion of the species range may be lower than indicated, due to potential for loss of major coastal subpopulation.

D. Non-habitat Factors. Species may be sensitive to global warming.

E. Inadequate Information. Species distribution is not well known.

F. Features of the Alternative. Primary feature is riparian reserves to maintain microclimate and to support adequate downed wood in vicinity of headwater and other small streams. Species is also associated with talus deposits near these creeks. These factors make management within riparian reserves, and the extent of those reserves, the primary concern.

V. Cumulative Effects Assessment. As indicated above, the coastal population occurs exclusively on nonfederal lands. The Olympic population occurs on both federal and nonfederal lands, with a majority on federal lands. Of the federal land, about 75 percent is protected within Late-Successional Reserves and Congressionally Reserved Areas (for entire species' range). Because of the isolation of subpopulations, nonfederal management practices will not significantly affect viability on the federal lands. The potential negative effects of global warming may be significant but cannot be predicted. Risk is subject to mitigation through forest management practices that reduce likelihood of losing isolated local populations.

VI. Summary. Low ratings for Outcome A reflect species naturally patchy distribution. Ratings for D reflects likelihood of extirpation due to uncertainty about long term effects of global change and environmental conditions. The Assessment Team rating in the FEMAT Report assumes occupied sites within key watersheds will be identified and protected through watershed analysis.

VII. Mitigation. Mitigation cannot improve ratings of Olympic Peninsula subpopulation resulting from potential loss of population on nonfederal lands.

I. Species. Clouded Salamander

II. FEMAT Rating. 81-18-1-0

III. Modifications due to changes in Alternative 9. No significant change.

IV. Explanation of Rating.

A. Natural History. Inhabits large logs and stumps of varying decay stage, usually under forested cover (especially in warmer, drier environments of California).

B. Past Actions.

C. Species Range. Overall, about 45 percent of species range is on federal land. However, in California only about 15 percent of range is federal. This results in a lower rating applied to the California population.

D. Non-habitat Factors. Not significant.

E. Inadequate Information.

F. Features of the Alternative. Primary factor is the amount, size, and decay class of downed wood in Matrix (and extent of Matrix).

V. Cumulative Effects Assessment. Because the majority of the species' range is on nonfederal lands in California, overall population persistence (especially in California Coast and Klamath provinces) has a lower likelihood than indicated by the ratings on federal lands.

VI. Summary. Species rating reflects greater extent of Matrix in Alternative 9 than in other Alternatives and uncertainty whether logs retention will be sufficient in the Matrix over the long run. Consideration of nonfederal lands, especially in California, resulted in the rating.

VII. Mitigation. As a result of the analysis described in parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Klamath and Coast range provinces of California within range of the species.

B. Specific Habitats. Large logs and stumps, especially decay classes 3-4.

C. Mitigation Measures. To partially compensate for increased risk to species persistence on nonfederal lands in California, levels of log retention should be increased in Matrix lands within the California Klamath and Coast provinces. Within these provinces (and within range of the species), retain logs > 16 inches diameter at levels comparable to the range of variation within unmanaged mature late-successional stands.

D. Benefits. Implementation of this mitigation will retain original ratings in light of cumulative effects.

I. Species. Larch Mountain Salamander

II. FEMAT Rating. 75-20-5-0

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of Rating.

A. Natural History. Associated with moist rocky outcrops and talus slopes under dense overstory cover below 3,400 feet. Populations are also known from lava tubes near Mount St. Helens and in association with coarse woody debris (e.g., Quartz Creek, C. Crisafulli, pers. comm.)

B. Past Actions. Disturbance of occupied sites may have caused local losses.

C. Species Range. Rare and locally endemic. About 64 percent of range is on federal land; of this, 56 percent is in Late-Successional Reserves or Congressionally Reserved Areas. Primary locality is within Columbia River Gorge and thus protected as reserve.

D. Non-habitat Factors. This may be a relict species susceptible to extirpation through catastrophic events.

E. Inadequate Information. Species distribution is very poorly known. Most current localities found within past 10 years.

F. Features of the Alternative. Extent of the reserved lands, especially measures to ensure protection of talus are key. Road building and other ground disturbing activities are primary threat to species, so standards and guidelines to restrict such activities within occupied sites are especially important.

V. Cumulative Effects Assessment. Overall, population size will be reduced with loss of populations on nonfederal lands and the species will not be as well distributed. Whether this will result in increased risk to long-term viability is unknown.

VI. Summary. Species is protected wherever it occurs on federal lands through existing protection buffers from the SAT Report incorporated as Standards and Guidelines in Alternative 9 and other alternatives. However, these protections buffer widths were judged by the original Assessment Team ratings in the FEMAT Report as not sufficient to fully protect sites, producing a lower rating in Outcome A.

VII. Mitigation. As a result of the analysis described in parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Throughout range of this species.

B. Specific Habitats. Talus and rocky slopes with dense conifer overstory.

C. Mitigation Measures. Under SEIS guidelines, measures already call for survey and protection of occupied sites. Because of concern for maintenance of understory habitat and microclimatic conditions, mitigation is to increase buffer width to 2 tree heights around perimeter of sites on south-facing slopes.

D. Benefits. Implementation of this mitigation will likely raise the likelihood of Outcome A to a level comparable to that of Alternative 1.

I. Species. Oregon Slender Salamander

II. FEMAT Rating. 70-24-6-0

III. Modifications due to changes in Alternative 9.

IV. Explanation of Rating.

A. Natural History. Species is associated with large, well-decayed coarse woody debris in association with late-successional forest cover. Often found in cracks within large logs.

B. Past Actions. Loss of logs through harvest activity and burning has resulted in reduced population size rangewide.

C. Species Range. Species is locally endemic within range of northern spotted owl. About 62 percent of its range is on federal lands; of this, 46 percent is within Congressionally Reserved Areas and Late-Successional Reserves.

D. Non-habitat Factors. None of significance.

E. Inadequate Information.

F. Features of the Alternative. About 41 percent of species range on federal lands is in the Matrix under Alternative 9, so management of large logs in the matrix is of particular importance.

V. Cumulative Effects Assessment. Forest management practices on nonfederal lands will affect overall population persistence. If practices result in reduction of numbers of large logs, population will decline.

VI. Summary. Rating in Outcome A reflects uncertainty about adequacy of log retention levels in the Matrix and within Late-Successional Reserves. Over the long run, species may become more restricted to reserves if adequate numbers of large logs are not retained.

VII. Mitigation. As a result of the analysis described in Parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Throughout species range.

B. Specific Habitats. Large, well-decayed logs.

C. Mitigation Measures. Manage Matrix and Late-Successional Reserves to retain a continuous supply of logs > 16 inches in diameter, well distributed over the area. Density and decay-class distribution should be within the range of variability of unmanaged late-successional stands.

D. Benefits. Implementation of mitigation will result in rating for Outcome A comparable to that of Alternatives 1 or

3.

I. Species. Shasta Salamander

II. FEMAT Rating. 0-40-40-20

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of Rating.

A. Natural History. Species associated with limestone rock outcrops. Occurs as naturally disjunct subpopulations that may be genetically isolated.

B. Past Actions. Mining and road building have eliminated local populations.

C. Species Range. Has smallest total range of any amphibian in the Pacific Northwest. About 66 percent of its range is federal; of this, 69 percent is in the Matrix under Alternative 9 and 7 percent is protected within Late-Successional Reserves or Congressionally Reserved Areas.

D. Non-habitat Factors. Small population size creates great uncertainty whether

species will persist over the long run, even with protective buffers.

E. Inadequate Information. Species is poorly known. Distribution is not well described.

F. Features of the Alternative. Species is protected wherever it occurs on federal lands through existing protection buffers from the SAT Report incorporated as Standards and Guidelines in Alternative 9 and other alternatives. Buffers to protect rock outcrops on occupied sites is key to species persistence. However, population size may be too small to ensure persistence.

V. Cumulative Effects Assessment. Because of small population size, any loss of local populations can be detrimental to long term persistence of species. Over a third of the species range is on nonfederal lands, so risk is great that local populations may be lost. The species is on California's sensitive species list, and this may confer some protection on nonfederal lands.

VI. Summary. Ratings reflect extremely localized distribution of this species and risk of extirpation due to small population size. Ratings were lower in Alternatives 7 and 8 because they do not incorporate SAT buffers as standards and guidelines, but ratings were similar across all other alternatives. Additional research is needed to better understand this species distribution and population demographics.

VII. Mitigation. No mitigation could be described for this species.

I. Species. Siskiyou Mountains Salamander

II. FEMAT Rating. 50-30-15-5

III. Modifications due to changes in Alternative 9. No significant changes.

IV. Explanation of Rating.

A. Natural History. Primary habitat is moist, mossy or humous-covered talus and rocky outcrops, especially on north-facing slopes with dense overstory canopy. Population is distributed in relatively isolated patches in relation to distribution of habitat.

B. Past Actions. Past disturbance of habitat from road building or other ground-disturbing activity has reduced total population size and may have further restricted distribution.

C. Species Range. Species has an extremely small range, only slightly larger than that of the Shasta Salamander. About 77 percent of its range is on federal land; of this 25 percent is within Late-Successional Reserve or Congressionally Reserved Areas.

Most (65 percent) of its range on federal lands is within the Applegate Adaptive Management Area.

D. Non-habitat Factors. Decline of species may result from genetic isolation of subpopulations and small population size.

E. Inadequate Information. Taxonomic status is uncertain (may be subspecies of Del Norte Salamander), but current evidence supports species status.

F. Features of the Alternative. Size and spacing of reserves and management practices in the Matrix and AMA are key factors. Alternative 9 standards and guidelines provide for protection of all occupied sites with protection buffers from the SAT Report.

V. Cumulative Effects Assessment. Overall population size will decline if harvest and other practices on the nonfederal portion of the species' range disrupt habitat. Long term persistence is also uncertain due to small population size and risk of loss to catastrophic events.

VI. Summary. Species rating reflects its naturally patchy distribution. Rating assumes standards and guidelines for protection buffers (from SAT Report), but this depends upon adequate survey to identify occupied sites before disturbance. Because of small population size, there will be some risk of extirpation regardless of protective measures undertaken.

VII. Mitigation. As a result of the analysis described in Parts I and II, possible mitigation measures were identified for this species and are described below.

A. Geographic Extent. Species range in its entirety.

B. Specific Habitats. Moist, mossy or humous-covered talus and rocky outcrops, especially on north-facing slopes with dense overstory canopy.

C. Mitigation Measures. Increase buffer width to 2 tree heights or 200 feet around perimeter of occupied sites (an increase from SAT Report recommendations). Specifically apply such protection within the Applegate Adaptive Management Area.

D. Benefits. Application of this mitigation will incrementally reduce risk of further loss of occupied sites, increasing rating for Outcomes A and B to similar level as Alternative 1.

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Fish

I. **Species.** Bull Trout (*Salvelinus confluentus*)

II. **FEMAT Rating.** 85-15-0-0

III. **Modifications due to changes in Alternative 9.** The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.

IV. **Explanation of Rating.**

A. **Natural History.** Bull trout are resident fish that inhabit small, headwater streams. Because they have relatively narrow habitat requirements, bull trout are not uniformly distributed and tend to be located in relatively isolated watersheds.

B. **Past Actions.** The quality and quantity of bull trout habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. **Species Range.** Northern California to headwaters of the Yukon River and eastward through the Columbia basin to rivers draining the eastside of the continental divide (Saskatchewan, Peace, and Laird Rivers). Bull trout has been eliminated from some of its native range.

D. **Non-habitat Factors.** Competition from stocked non-native species (i.e. brook trout) can impact survival and growth of bull trout on federal lands. Sport harvest may also impact the number of adults available to spawn on federal lands.

E. **Inadequate Information.** There is currently adequate information to conduct this review; lack of information is of less concern than the other explanations for the original FEMAT rating.

F. **Features of the Alternative.** Most bull trout habitat is contained within Key Watersheds and so Riparian Reserve width on intermittent streams was an important feature influencing the rating. This related to the decreased potential risk to aquatic system from the increased riparian area protection (Fig. V-12 p V-27). The net acreage of forest in Late-Successional Reserve (LSR) also contributed to the rating. Forest in LSR was expected to be subject to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. **Cumulative Effects Assessment.** Federal lands currently provide most of the highest quality water and bull trout habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are inadequate to provide well distributed, stabilized

populations. There are two classes of cumulative effects that are possible from activities off federal lands: those activities which in turn impact federal habitat, and those occurring during migratory life history phases. Federal lands tend to occur higher in a watershed than non-federal land, consequently the down stream impacts to habitat from non-federal activities are probably not extensive. However, since these fish often occur in isolated headwater streams, such impacts, when they do occur, may be devastating. Finally, some stocks of these resident fish may undergo freshwater migrations and move onto non-federal lands where they would be impacted by non-federal activities.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Resident bull trout are dependent upon high quality freshwater habitat throughout their entire life cycle. Although habitat quality and quantity on federal lands is currently degraded throughout the range of bull trout, much of the habitat is contained within Key Watersheds. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater the area in Late-successional and Riparian Reserves, the lower the future risk to habitat. Alternative 9 had less area in LSR than Alternatives 1, 2, 3, 4, 6, 8, and 10 and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than Alternatives 1 and 4. Although possibly at a slower rate than other alternatives, Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. As a result of the review, it was determined that mitigation may improve ratings for bull trout habitat on federal land. The possible mitigations are described in the following section.

A. Geographic Extent. The mitigation could be applied throughout the range of the species, or limited to 1) areas occupied by populations known to be impacted, or 2) to river basins/provinces characterized by relatively unstable geology and landforms. Given the current distribution of the species, mitigation decisions can be made at regional, provincial/basin, or watershed scales.

For mitigation decisions made at a regional planning level, it should be remembered that the broader-scope mitigation will give greater confidence that the measure will successfully reduce risk to bull trout populations. Conversely, if mitigation decisions are made which target geographic areas smaller than the species range, some issues must be considered: 1) if mitigation is limited to watersheds containing populations known to be impacted, the currently healthy populations will receive less protection; and 2) although the data is available, it has not been compiled and analyzed at a sufficiently detailed scale (30 m digital elevation models) to identify unstable watersheds or watersheds. Relatively unstable provinces/basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitats. On federal lands, high quality aquatic and riparian habitats are needed to support the fish species.

C. Mitigation Measures. Provide greater protection to Tier I Key Watersheds containing bull trout with mitigation measures such as removing the watersheds from the timber-suitable base, or not building new roads and removing existing roads.

D. Benefits. Most bull trout on federal land occur within Key Watersheds, and measures taken to protect these watersheds will benefit the species' habitat.

I. Species. Coho Salmon (*Oncorhynchus kisutch*)

II. FEMAT Rating. 65-20-15-0

III. Modifications due to changes in Alternative 9. The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.

IV. Explanation of Rating.

A. Natural History. Coho salmon are anadromous, generally spending 1-2 year in freshwater prior to smoltification and ocean migration. They are found in a broad diversity of stream sizes. Their winter-rearing is preferentially in low gradient areas containing abundant backwater pools and off-channel habitat. Large woody debris is an important complexity element in these habitats.

B. Past Actions. The quality and quantity of fresh water coho salmon habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. Species Range. California to Alaska and eastward into the lower tributaries of the Columbia basin.

D. Non-habitat Factors. Dams influence migration timing and success. Competitive and genetic impacts from hatchery fish can affect coho salmon survival, growth, and reproduction on federal lands. Global climate change was also a concern.

E. Inadequate Information. There is currently adequate information to conduct these review; lack of information is of less concern than the other explanations of the ratings.

F. Features of the Alternative. Riparian Reserve width on intermittent streams in non-Tier 1 Key Watersheds was an important feature influencing the rating. This related to increased potential aquatic system risk from decreased riparian area protection (Fig. V-12 p V-27). The acreage of forest in Late-successional Reserve (LSR) also contributed

to the rating. Forest in LSR was thought to be subjected to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. Cumulative Effects Assessment. Federal lands currently provide most of the highest quality water and fish habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are inadequate to provide well distributed, stabilized populations of coho salmon. As a result, there are two classes of cumulative effects are possible from activities off federal land: those on nonfederal actions that impact federal habitat, and those occurring during migratory or oceanic life history phases. The first class of activities, occurs infrequently since federal lands tend to occur higher in a watershed than non-federal land. The second class of activities includes physical (i.e. dams) or chemical (i.e. poor water quality) migratory barriers may hinder movement of coho salmon between freshwater habitat on federal lands and the ocean. Commercial and sport harvest may also impact the number of adults returning to spawn on federal lands.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Although coho are migratory, they are dependent upon high quality freshwater habitat for up to two years. Habitat quality and quantity on federal lands is currently degraded throughout the range of coho salmon. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater the area in Late-successional and Riparian Reserves, the lower the future risk to habitat. Alternative 9 had less area in LSR than in Alternatives 1, 2, 3, 4, 6, 8, and 10; and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than in Alternatives 1 and 4. Although possibly at a slower rate than other alternatives, Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. As a result of the review, it was determined that mitigation may improve ratings for coho salmon habitat. These possible mitigations are described below.

A. Geographic Extent. The mitigation measures could be applied throughout the range of the species; or limited to areas occupied by: 1) identified Evolutionarily Significant Units (ESU) to be defined by NMFS; 2) at-risk stocks; or 3) to river basins/provinces characterized by relatively unstable geology and landforms. Since this species is evenly distributed throughout its range, mitigation decisions can be made at regional, provincial/basin, or watershed scales.

For mitigation decisions made at a regional planning level, the broader the scope of implementation, the greater the confidence that the measure will successfully reduce risk to coho salmon populations. Also, if the decision is made to target mitigation on geographic areas smaller than the species range, there are issues which must be considered: 1) NMFS has not yet identified ESUs for this species, but a status review is being conducted to determine if listing is warranted under the Endangered Species Act; 2) if mitigation is limited to watersheds containing at-risk stocks, then currently

healthy populations will receive less protection and would be susceptible to declining condition of habitat; and 3) although the data is available to identify unstable watersheds, it has not been compiled and analyzed at a sufficiently detailed scale (30 m digital elevation models). Only the relatively unstable Provinces/Basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitat. On Federal lands, high quality aquatic and riparian habitats are needed to support the fish species.

C. Mitigation Measures. Although a long-term restoration strategy is necessary, restoration, without other short-term mitigation measures, will be insufficient to decrease risk to habitat to coho habitat. Mitigation measures include: 1) applying Riparian Reserve Scenario 1 in all watersheds; 2) removing Tier I Key Watersheds from the timber-suitable base; 3) prohibiting new road construction and requiring a net road reduction in Tier I Key Watersheds; and 4) reducing the acreage that is available for timber harvest by removing inventoried roadless areas from the timber-suitable base.

D. Benefits. The four possible mitigation measures would have a range of benefits to coho salmon:

1) Application of Riparian Reserve Scenario 1 may substantially reduce the risk to habitat, especially in coastal areas that "have a large number of at-risk-stocks (V-C), large areas of unstable land (figs V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (fig V-25)" (FEMAT). If applied throughout the range of the species, Riparian Reserve Scenario 1 would be the most extensive mitigation suggested and would achieve outcomes for Alternative 9 similar to those for Alternative 4.

2) The mitigation measure which would remove the Key Watersheds from the timber-suitable base would ensure that the system established by Key Watersheds has limited disturbance from timber harvest and related activities (i.e. road and landing construction). Removal of these areas from the timber-suitable base is particularly valuable in the short-term since the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly benefits all fish stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as they recover. Implementation of this mitigation would likely achieve outcomes for Alternative 9 similar to those for reported for Alternative 4.

3) The third possible mitigation was to reduce risk to Key Watersheds by prohibiting new road construction and requiring a net road reduction in these watersheds. This mitigation addresses one of the primary impacts of timber harvest activities to fish habitat by reducing the potential for road-related disturbance (i.e. increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation would probably be less than that derived from removing Key Watersheds from the timber-suitable base, it would be valuable.

4) The fourth possible mitigation may be somewhat constrained by the coincidence of inventoried roadless areas and watersheds containing habitat for the species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT, Table V-8 p.V-52). Inventoried roadless areas, by definition, tend to be large (5000 acres minimum) with limited disturbance and limited fragmentation. Thus, they frequently contain high quality habitat. Roadless areas are also often characterized by significant amounts of unstable land. Removal of these areas from the timber-suitable base would reduce the potential for generating sediment from these erosion- and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be greater than indicated solely by the number of acres, due to the exceptionally high quality of habitat in roadless areas and the percent overlap of roadless areas with Key Watersheds.

The latter two mitigation possibilities could be combined to achieve greater benefits to coho salmon. Removal of inventoried roadless areas from the timber-suitable base, in combination with a prohibition on new road construction and required road removal, would likely achieve outcomes that are in the range between those of Alternatives 2 and 4.

I. Species. Fall Chinook Salmon (*Oncorhynchus tshawytscha*)

II. FEMAT Rating. 65-25-10-0

III. Modifications due to changes in Alternative 9. The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.

IV. Explanation of Rating.

A. Natural History. Fall chinook salmon are anadromous. These stocks usually move to the ocean during their first year after rearing in freshwater for 3-6 months. The estuarine residence of these fish as smolts may be up to several months and is important to their survival. Although found in a broad diversity of stream sizes, chinook salmon are most abundant in larger river systems and may be absent from smaller coastal and inland rivers that are inhabited by coho salmon (Meehan and Bjornn, 1991).

B. Past Actions. The quality and quantity of fresh water fall chinook salmon habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. Species Range. California to Alaska and eastward through the Columbia basin.

D. Non-habitat Factors. Dams influence migration timing and success. Competitive and genetic impacts from hatchery fish can affect survival, growth, and reproduction of fall chinook salmon on federal lands.

E. Inadequate Information. There is currently adequate information to conduct these analyses; lack of information is of less concern than the other explanations for the FEMAT ratings.

F. Features of the Alternative. Riparian Reserve width on intermittent streams in non-Tier 1 Key Watersheds was an important feature influencing the rating. This related to increased potential aquatic system risk from decreased riparian area protection (Fig. V-12 p V-27). The acreage of forest in Late-Successional Reserve (LSR) also contributed to the rating. Forest in LSR is expected to be subject to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. Cumulative Effects Assessment. Federal lands currently provide most of the highest quality water and fish habitat within the range of the northern spotted owl. Most fall chinook habitat is on state and private lands and is of insufficient quality to provide well distributed, stabilized populations. There are two classes of cumulative effects possible from activities off federal lands: those nonfederal activities which impact federal habitat, and those effects occurring during migratory or oceanic life history phases. The first class of activities, in most cases, is of less concern since federal lands tend to occur higher in a watershed than non-federal land. The second class of activities includes physical (i.e. dams) or chemical (i.e. poor water quality) migratory barriers may hinder movement of fall chinook salmon between freshwater habitat on federal lands and the ocean. Also commercial and sport harvest have a large impact on the number of adults returning to spawn on federal lands. Finally, degraded habitat conditions in estuaries may have contributed to fall chinook declines on federal lands.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Although fall chinook salmon are migratory, they are dependent upon high quality freshwater habitat in which to spawn and rear for up to 6 months. Habitat quality and quantity on federal lands is currently degraded throughout the range of fall chinook salmon. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater the area in Late-successional and Riparian Reserves, the lower the future risk to habitat. Alternative 9 had less area in LSR than in Alternatives 1 and 4 and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than Alternatives 1, 2, 3, 4, 6, 8, and 10. Although possibly at a slower rate than other options, Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. As a result of this review it was determined that mitigation may improve

ratings for fall chinook salmon habitat. These possible mitigations are described below.

A. Geographic Extent: The mitigations could be applied throughout the range or the species, or limited to areas occupied by: 1) identified Evolutionarily Significant Units (ESU) as defined by NMFS; 2) at-risk stocks; or 3) to river basins/provinces characterized by relatively unstable geology and landforms. Since this species is somewhat evenly distributed throughout its range, mitigation decisions can be made at regional, provincial/basin, or watershed scales.

For mitigation decisions made at a regional planning level, the broader the scope of implementation, the greater the confidence that the measure will successfully reduce risk. If regional scale mitigation decisions are made to target geographic areas smaller than the range, then there are some issues which must be considered: 1) NMFS has not yet identified ESUs for this species; 2) if mitigation is limited to watersheds containing at-risk stocks, then currently healthy populations will receive less protection; and 3) although the data is available, it has not been compiled and analyzed for the region at a sufficiently detailed scale (30 m digital elevation models) to identify unstable watersheds. Relatively unstable provinces/basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitats. On federal lands, high quality aquatic and riparian habitats are needed to support the fish species.

C. Mitigation Measures. Although a long-term restoration strategy is necessary, restoration, without other short-term mitigation measures, will be insufficient to decrease risk to habitat. Mitigation measures include: 1) applying Riparian Reserve Scenario 1 in all watersheds; 2) Removing Tier I Key Watersheds from the timber-suitable base; 3) Prohibiting new road construction and requiring a net road reduction in Tier I Key Watersheds; and 4) Reducing the acreage that is available for harvest by removing inventoried roadless areas from the timber-suitable base.

D. Benefits. The four possible mitigation measures would provide a range of benefits to chinook salmon habitat:

1) Application of Riparian Reserve Scenario 1 could substantially reduce the risk to fall chinook habitat, especially in coastal areas that "have a large number of at-risk-stocks (V-C), large areas of unstable land (figs V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (fig V-25)" (FEMAT). If applied throughout the range of the species, Riparian Reserve Scenario 1 would be the most extensive mitigation suggested and would achieve outcomes for Alternative 9 similar to those for Alternative 4.

2) This mitigation measure would ensure that the system established by Key Watersheds is subject to limited disturbance from timber harvest and related activities (i.e. road and landing construction). Removal of Key Watersheds from the timber-suitable base is particularly valuable in the short-term, because the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly

benefits all fish stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as they recover. Implementation of this mitigation would likely achieve outcomes for Alternative 9 similar to those for Alternative 4.

3) The risk to habitat in Key Watersheds could also be reduced by prohibiting new road construction and requiring a net road reduction in these watersheds. This mitigation would address one of the primary impacts of timber harvest activities by reducing the potential for road-related disturbance (i.e. increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation would probably be less than that derived from removing Key Watersheds from the timber-suitable base, it would be valuable.

4) The benefit of this mitigation may be somewhat constrained by the coincidence of roadless areas and watersheds containing habitat for the species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT, Table V-8 p.V-52). Inventoried roadless areas, by definition, tend to be large (5000 acres minimum) with limited disturbance and fragmentation of aquatic and forest habitat. Thus, they frequently contain high quality habitat. Roadless areas are often characterized by significant amounts of unstable land. Removal of these areas from the timber-suitable base would reduce the potential for generating sediment from these erosion- and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be in excess of the benefits indicated solely by the number of affected acres due to the exceptionally high quality of habitat provided and the percent overlap of roadless areas with Key Watersheds.

The latter two mitigation possibilities could be combined to provide further benefits to the species. Removal of inventoried roadless areas from the timber-suitable base in combination with a prohibition on new road construction and required road removal would likely achieve outcomes that are in the range between those of Alternatives 2 and 4.

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- I. Species: Resident Cutthroat Trout (*Oncorhynchus clarki clarki*)
and Resident Rainbow Trout (*Oncorhynchus macaw*s)
- II. FEMAT Rating: 60-25-15-0
- III. Modifications due to changes in Alternative 9. The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.
- IV. Explanation of Rating.
- A. Natural History. Resident cutthroat and rainbow trout inhabit small, headwater streams.

B. Past Actions. The quality and quantity of fresh water resident cutthroat and rainbow trout habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. Species Range. Cutthroat Trout - Northern California to Alaska and eastward through the Columbia basin. Rainbow Trout - California to Alaska and eastward through the Columbia basin.

D. Non-habitat Factors. Competitive and genetic impacts from stocked native and non-native species can affect survival, growth, and reproduction of resident cutthroat and rainbow trout on federal lands. Sport harvest may also impact the number of adults available to spawn on federal lands.

E. Inadequate Information. Less is known about these fish than the anadromous forms of the same species, especially concerning genetics.

F. Features of the Alternative. Riparian Reserve width on intermittent streams in non-Tier 1 Key Watersheds was an important feature influencing the rating. This related to increased potential aquatic system risk from decreased riparian area protection (Fig. V-12 p V-27). The acreage of forest in Late-successional Reserve (LSR) also contributed to the rating. Forest in LSR was thought to be subjected to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. Cumulative Effects Assessment. Federal lands currently provide most of the highest quality water and resident trout habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are inadequate to provide well distributed, stabilized populations. Two classes of cumulative effects are possible from activities off federal lands: those nonfederal activities which in turn impact federal habitat, and those occurring during migratory life history phases. Federal lands tend to occur higher in a watershed than non-federal land, consequently down stream impacts from non-federal lands are probably not extensive. Since these fish often occur in isolated headwater streams, such impacts, when they do occur, may be devastating. Some stocks of these resident fish may undergo freshwater migrations and move onto non-federal lands.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Resident cutthroat and rainbow trout are dependent upon high quality freshwater habitat throughout their entire life cycle. Habitat quality and quantity on federal lands is currently degraded throughout the range of resident cutthroat and rainbow trout. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater

the area in Late-successional and Riparian Reserves, the lower the future risk to habitat. Alternative 9 had less area in LSR than Alternatives 1,2,3,4,6,8, and 10 and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than in Alternatives 1 and 4. Although possibly at a slower rate than other options, Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. As a result of this review, it was determined that mitigation may improve ratings for resident cutthroat and rainbow trout habitat. The possible mitigation measures are discussed below.

A. Geographic Extent. The mitigation measures could be applied throughout the range of the species, or limited to: 1) areas occupied by populations known to be adversely impacted, or 2) to river basins/provinces characterized by relatively unstable geology and landforms. Since these species are widely distributed throughout their range, mitigation decisions can be made at regional, provincial/basin, or watershed scales.

For mitigation decisions made at a regional planning level, it should be remembered that the broader the scope of implementation, the greater the confidence that the measure will successfully reduce risk. Conversely, if mitigation decisions are made which target geographic areas smaller than the species range, some issues must be considered: 1) if mitigation is limited to watersheds containing populations known to be impacted, the currently healthy populations will receive less protection; and 2) although the data is available, it has not been compiled and analyzed at a sufficiently detailed scale (30 m digital elevation models) to identify unstable watersheds. Relatively unstable provinces/basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitats. On federal lands, high quality aquatic and riparian habitats are needed to support the fish species.

C. Mitigation Measures. Although a long-term restoration strategy is necessary, restoration, without other short-term mitigation measures, will be insufficient to decrease risk to habitat. Mitigation measures include: 1) applying Riparian Reserve Scenario 1 in all watersheds; 2) removing Tier I Key Watersheds from the timber-suitable base; 3) prohibiting new road construction and requiring a net road reduction in Tier I Key Watersheds; 4) reducing the area that is available for harvest by removing inventoried roadless areas from the timber-suitable base.

D. Benefits. The four mitigation possibilities would offer a range of benefits to trout species:

1) Application of Riparian Reserve Scenario 1 may substantially reduce the risk to habitat especially in coastal areas that "have a large number of at-risk-stocks (V-C), large areas of unstable land (figs V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (fig V-25)" (FEMAT). If applied throughout the range of the species, Riparian Reserve Scenario 1 would be the

most extensive mitigation suggested and would achieve outcomes for Alternative 9 similar to those for Alternative 4.

2) This mitigation measure would ensure that the system established by Key Watersheds is subjected to limited disturbance from timber harvest and related activities (i.e. road and landing construction). Removal of these areas from the timber-suitable base is particularly valuable in the short-term since the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly benefits stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as these recover. Implementation of this mitigation would likely achieve outcomes for this alternative similar to those for Alternative 4.

3) The risk to Key Watersheds would be reduced by prohibiting new road construction and requiring a net road reduction. This mitigation addresses one of the primary impacts of timber harvest activities by reducing the potential for road-related disturbance (i.e. increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation would probably be less than that derived from removing Key Watersheds from the timber-suitable base, it would still be valuable.

4) The benefit of this mitigation may be somewhat constrained by the coincidence of roadless areas and watersheds containing habitat for the species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT, Table V-8 p.V-52). Inventoried roadless areas, by definition, tend to be large (5000 acres minimum) with limited disturbance and fragmentation of the aquatic and forest habitat. Thus, they frequently contain high quality habitat. Roadless areas are often characterized by significant amounts of unstable land. Removal of these areas from the timber-suitable base would reduce the potential for generating sediment from these erosion- and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be in excess of the benefits indicated solely by the number of affected acres due to the exceptionally high quality of habitat provided and the percent overlap of roadless areas with Key Watersheds.

The latter two mitigation possibilities could be combined to achieve greater benefits for the species. Removal of inventoried roadless areas from the timber-suitable base in combination with a prohibition on new road construction and required road removal would likely achieve outcomes that are in the range between those of Alternatives 2 and 4.

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- I. Species. Sea-run Cutthroat Trout (*Oncorhynchus clarki clarki*)
 - II. FEMAT Rating. 65-20-15-0

III. Modifications due to changes in Alternative 9. The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.

IV. Explanation of Rating.

A. Natural History. Sea-run cutthroat trout are anadromous. They generally spend one to two years in fresh water before migrating in spring to the near-shore salt water environment. After this initial summer, sea-run cutthroat may move between winter in fresh water and summer in the ocean. These fish may be considered as the species most closely associated with coastal forests. They have a strong affinity for deep pools and large woody debris.

B. Past Actions. The quality and quantity of fresh water sea-run cutthroat trout habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. Species Range. Northern California to Alaska and eastward to lower tributaries of the Columbia basin.

D. Non-habitat Factors. Competitive and genetic impacts from hatchery fish can affect survival, growth, and reproduction of sea-run cutthroat trout on federal lands. Sport harvest can reduce the number of fish returning to spawn on federal lands.

E. Inadequate Information. There is currently adequate information to conduct these analyses; lack of information is of less concern than the other explanations of the rating.

F. Features of the Alternative. Riparian Reserve width on intermittent streams in non-Tier 1 Key Watersheds was an important feature influencing the rating. This related to increased potential aquatic system risk from decreased riparian area protection (Fig. V-12 p V-27). The acreage of forest in Late-successional Reserve (LSR) also contributed to the rating. Forest in LSR was thought to be subjected to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. Cumulative Effects Assessment. Federal lands currently provide most of the highest quality water and sea-run cutthroat trout habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are inadequate to provide well distributed, stabilized populations. Two classes of cumulative effects are possible from activities off federal lands: those on federal habitat and those occurring during migratory or oceanic life history phases. The first class of activities, in most cases, is of less concern than the second since federal lands tend to occur higher in a watershed than non-federal land. Chemical migratory barriers (i.e. poor water quality) may hinder movement of sea-run cutthroat trout

between freshwater habitat on federal lands and the ocean. Sport harvest may also impact the number of adults returning to spawn on federal lands. Degraded habitat conditions in estuaries may contribute to declines of sea-run cutthroat trout on federal lands.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Although sea-run cutthroat trout are migratory, they are dependent upon high quality freshwater habitat for up to two years. Habitat quality and quantity on federal lands is currently degraded throughout the range of sea-run cutthroat trout. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater the area in Late-successional and Riparian Reserves, the lower the future risk to habitat. Alternative 9 had less area in LSR than Alternatives 1, 2, 3, 4, 6, 8, and 10 and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than in Alternatives 1 and 4. Although possibly at a slower rate than other alternatives, Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. Through this review process it was determined that mitigation may improve ratings for sea-run cutthroat trout habitat.

A. Geographic Extent. The mitigation could be applied throughout the range of the sea-run cutthroat, or limited to: 1) areas occupied by identified Evolutionarily Significant Units (ESU) as defined by NMFS; 2) at-risk stocks; or 3) river basins/provinces characterized by relatively unstable geology and landforms. Less is known about this species and its distribution than is generally understood about other anadromous salmonid species. Thus, the ability to make mitigation decisions at scales below the regional or provincial/basin level may be somewhat constrained.

For mitigation decisions made at a regional planning level, the broader the scope of implementation, the greater the confidence that the measure will successfully reduce risk. If regional scale mitigation decisions are made to target geographic areas smaller than the range, then there are some issues which must be considered: 1) NMFS has not yet identified ESUs for this species, but a status review is being conducted to determine if listing of the Umpqua River stock is warranted under the Endangered Species Act; 2) if mitigation is limited to watersheds containing at-risk stocks, then currently healthy populations will receive less protection; 3) although the data is available, it has not been compiled and analyzed for the region at a sufficiently detailed scale (30 m digital elevation models) to identify unstable watersheds. Relatively unstable provinces/basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitats. On federal lands, high quality aquatic and riparian habitats are needed to support the fish species

C. Mitigation Measures. Although a long-term restoration strategy is necessary, restoration, without other short-term mitigation measures, will be insufficient to

decrease risk to habitat. Mitigation measures include: 1) applying Riparian Reserve Scenario 1 in all watersheds; 2) removing Tier I Key Watersheds from the timber-suitable base; 3) prohibiting new road construction and requiring a net road reduction in Tier I Key Watersheds; 4) reducing the acreage that is available for timber harvest by removing inventoried roadless areas from the timber-suitable base.

D. Benefits. The four possible mitigation measures would have a range of benefits for sea-run cutthroat trout:

1) Application of Riparian Reserve Scenario 1 for all intermittent streams may substantially reduce the risk to habitat especially in coastal areas that "have a large number of at-risk-stocks (V-C), large areas of unstable land (figs V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (fig V-25)" (FEMAT). If applied throughout the range of the species, Riparian Reserve Scenario 1 would be the most extensive mitigation suggested and would achieve outcomes for Alternative 9 similar to those for Alternative 4.

2) This mitigation measure would ensure that the system established by Key Watersheds is subjected to limited disturbance from timber harvest and related activities (i.e. road and landing construction). Removal of these areas from the timber-suitable base is particularly valuable in the short-term since the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly benefits stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as these recover. Implementation of this mitigation would likely achieve outcomes for this alternative similar to those for Alternative 4.

3) The risk to Key Watersheds would be reduced by prohibiting new road construction and requiring a net road reduction. This mitigation addresses one of the primary impacts of timber harvest activities by reducing the potential for road-related disturbance (i.e. increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation would probably be less than that derived from removing Key Watersheds from the timber-suitable base, it would be valuable.

4) The benefit of this mitigation may be somewhat constrained by the coincidence of roadless areas and watersheds containing habitat for the species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT, Table V-8 p.V-52). Inventoried roadless areas, by definition, tend to be large (5000 acres minimum) with limited disturbance and limited fragmentation. Thus, they frequently contain high quality habitat. Roadless areas are often characterized by significant amounts of unstable land. Removal of these areas from the timber-suitable base would reduce the potential for generating sediment from these erosion- and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be in excess of the benefits indicated solely by the number of affected acres due to the exceptionally high quality of habitat provided and the percent overlap of roadless areas with Key

Watersheds.

The latter two mitigation possibilities could be combined to achieve greater benefits. Removal of inventoried roadless areas from the timber-suitable base in combination with a prohibition on new road construction and required road removal would likely achieve outcomes that are in the range between those of Alternatives 2 and 4.

I. **Species.** Spring Chinook Salmon (*Oncorhynchus tshawytscha*) and Summer Steelhead Trout (*Oncorhynchus macawsi gairdneri*)

II. **FEMAT Rating.** 65-25-10-0

III. **Modifications due to changes in Alternative 9.** The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.

IV. **Explanation of Rating.**

A. **Natural History.** Spring chinook salmon are anadromous. Spring-run stocks generally move seaward during the spring of the second year. Although found in a broad diversity of stream sizes, chinook salmon are most abundant in larger river systems and may be absent from smaller coastal and inland rivers that are inhabited by coho salmon (Meehan and Bjornn, 1991). Their distribution may be patchy making them susceptible to disturbance.

Summer steelhead trout are anadromous. Summer-run fish return to fresh water during June through September, migrate inland toward spawning areas, overwinter in larger streams, resume migration in early spring and then spawn in natal streams (Meehan and Bjornn, 1991). Steelhead juveniles may spend up to four years in fresh water before going to sea. Summer steelhead trout can spawn in smaller streams than those used by spring chinook salmon.

B. **Past Actions.** These fish are very susceptible to habitat alteration due in part to an extended juvenile residency in fresh water. The quality and quantity of fresh water spring chinook salmon and summer steelhead trout habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. **Species Range.** California to Alaska and eastward through the Columbia basin.

D. **Non-habitat Factors.** Dams influence migration timing and success. Competitive and genetic impacts from hatchery fish can affect survival, growth, and reproduction

of spring chinook salmon and summer steelhead trout on federal lands.

E. Inadequate Information. There is currently adequate information to conduct these analyses; lack of information is of less concern than the other explanations for ratings.

F. Features of the Alternative. Riparian Reserve width on intermittent streams in non-Tier 1 Key Watersheds was an important feature influencing the rating. This related to increased potential aquatic system risk from decreased riparian area protection (Fig. V-12 p V-27). The acreage of forest in Late-Successional Reserve (LSR) also contributed to the rating. Forest in LSR was thought to be subjected to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. Cumulative Effects Assessment. Federal lands currently provide most of the highest quality water and spring chinook salmon and summer steelhead trout habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are inadequate to provide well distributed, stabilized populations. Two classes of cumulative effects are possible from activities off federal lands: those nonfederal activities which result in impacts to federal habitat, and those occurring during migratory or oceanic life history phases. The first class of activities, in most cases, is of less concern than the second since federal lands tend to occur higher in a watershed than non-federal land. Physical (i.e. dams) or chemical (i.e. poor water quality) migratory barriers may hinder movement of spring chinook salmon and summer steelhead trout between freshwater habitat on federal lands and the ocean. Commercial and sport harvest may also impact the number of adults returning to spawn on federal lands.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Although spring chinook salmon and summer steelhead trout are migratory, they are dependent upon high quality freshwater habitat for extended periods, up to 4 years for summer steelhead trout. Habitat quality and quantity on federal lands is currently degraded throughout the range of spring chinook salmon and summer steelhead trout. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater the acreage in Late-Successional and Riparian Reserves, the lower the future risk to fish habitat. Alternative 9 had less area in LSR than Alternatives 1, 2, 3, 4, 8, and 10 and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than Alternatives 1 and 4. Although possibly at a slower rate than other options, Alternative 9 was considered sufficient to "reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. The review reported on here resulted in the determination that mitigation may improve ratings for spring chinook salmon and summer steelhead trout habitat.

A. Geographic Extent. The possible mitigations could be applied throughout the range of these species, or limited to 1) areas occupied by identified Evolutionarily Significant Units (ESU) as defined by NMFS; 2) at-risk stocks or; 3) river

basins/provinces characterized by relatively unstable geology and landforms. Although Spring Chinook Salmon distribution may be patchy, both species are relatively widely distributed throughout their ranges. Thus, mitigation decisions can be made at regional, provincial/basin, or watershed scales.

For mitigation decisions made at a regional planning level, the broader the scope of implementation, the greater the confidence that the measure will successfully reduce risk. If regional scale mitigation decisions are made to target geographic areas smaller than the range, then there are some issues which must be considered: 1) NMFS has not yet identified ESUs for these species; 2) if mitigation is limited to watersheds containing at-risk stocks, then currently healthy populations will receive less protection; and 3) although the data is available, it has not been compiled and analyzed for the region at a sufficiently detailed scale (30 m digital elevation models) to identify unstable watersheds. Relatively unstable provinces/basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitats. On federal lands, high quality aquatic and riparian habitats are needed to support the fish species.

C. Mitigation Measures. Although a long-term restoration strategy is necessary, restoration, without other short-term mitigation measures, will be insufficient to decrease risk to habitat. Mitigation measures include: 1) applying Riparian Reserve Scenario 1 in all watersheds; 2) removing Tier I Key Watersheds from the timber-suitable base; 3) prohibiting new road construction and requiring a net road reduction in Tier I Key Watersheds; 4) reducing the area that is available for harvest by removing inventoried roadless areas from the timber-suitable base.

D. Benefits. The four mitigation measures will provide a range of benefits:

1) Application of Riparian Reserve Scenario 1 may substantially reduce the risk to habitat, especially in coastal areas that "have a large number of at-risk-stocks (V-C), large areas of unstable land (figs V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (fig V-25)" (FEMAT). If applied throughout the range of the species, Riparian Reserve Scenario 1 would be the most extensive mitigation suggested and would achieve outcomes for this Alternative similar to those for Alternative 4.

2) The mitigation measure of further protection of Key Watersheds would ensure that the system established by Key Watersheds is subjected to limited disturbance from timber harvest and related activities (i.e. road and landing construction). Removal of these areas from the timber-suitable base is particularly valuable in the short-term since the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly benefits stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as these recover. Implementation of this mitigation would likely achieve outcomes for this alternative similar to those for Alternative 4.

3) Another method of protecting Key Watersheds would be prohibition of new road construction and requiring a net road reduction in these watersheds. This mitigation addresses one of the primary impacts of timber harvest activities by reducing the potential for road-related disturbance (i.e. increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation would probably be less than that of removing Key Watersheds from the timber-suitable base, it would be valuable.

4) The benefit of this mitigation may be somewhat constrained by the coincidence of roadless areas and watersheds containing habitat for the species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT, Table V-8 p.V-52). Inventoried roadless areas, by definition, tend to be large (5000 acres minimum) with limited disturbance and limited fragmentation. Thus, they frequently contain high quality habitat. Roadless areas are often characterized by significant amounts of unstable land. Removal of these areas from the timber-suitable base would reduce the potential for generating sediment from these erosion- and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be in excess of the benefits indicated solely by the number of affected acres due to the exceptionally high quality of habitat provided and the percent overlap of roadless areas with Key Watersheds.

Two of the described mitigations measures could be combined to achieve further benefits. Removal of inventoried roadless areas from the timber-suitable base, in combination with a prohibition on new road construction and required road removal would likely achieve outcomes that are in the range between those of Alternatives 2 and 4.

I. Species. Winter Steelhead Trout (*Oncorhynchus macaw's gairdneri*)

II. FEMAT Rating. 65-25-10-0

III. Modifications due to changes in Alternative 9. The changes which had been made to Alternative 9 prior to the additional species analysis would not have led to a change in the original FEMAT assessment rating for this species.

IV. Explanation of Rating.

A. Natural History. Winter steelhead trout are anadromous. Winter-run fish return to fresh water during fall or winter, migrate inland toward spawning areas, then spawn in late winter or early spring (Meehan and Bjornn, 1991). Steelhead juveniles may spend up to four years in fresh water before going to sea.

B. Past Actions. These fish are very susceptible to habitat alteration due in part to an extended juvenile residency in fresh water. The quality and quantity of fresh water winter steelhead trout habitat has been reduced on federal lands by timber harvest and road construction. This was a primary factor in the rating (see discussion in

FEMAT V-12 - V-29). "The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years (see Chapter IV). Similarly, we expect that degraded aquatic ecosystems will not be fully functional in 100 years" (FEMAT V-68).

C. Species Range. California to Alaska and eastward through the Columbia basin.

D. Non-habitat Factors. Dams influence migration timing and success and competition from hatchery fish can impact survival and growth of winter steelhead trout on federal lands.

E. Inadequate Information. There is currently adequate information to conduct these analyses; lack of information is of less concern than the other explanations for FEMAT ratings.

F. Features of the Alternative. Riparian Reserve width on intermittent streams in non-Tier 1 Key Watersheds was an important feature influencing the rating. This related to increased potential aquatic system risk from decreased riparian area protection (Fig. V-12 p V-27). The acreage of forest in Late-successional Reserve (LSR) also contributed to the rating. Forest in LSR was thought to be subjected to less timber/road generated disturbance than matrix forest, thus, the potential risk to streams should be lower within LSRs.

V. Cumulative Effects Assessment. Federal lands currently provide most of the highest quality water and winter steelhead trout habitat within the range of the northern spotted owl. Habitat conditions on state and private lands are inadequate to provide well distributed, stabilized populations. Two classes of cumulative effects are possible from activities off federal lands: those nonfederal activities which impact federal habitat, and those effects occurring during migratory or oceanic life history phases. The first class of activities, in most cases, is of less concern than the second since federal lands tend to occur higher in a watershed than non-federal land. Physical (i.e. dams) or chemical (i.e. poor water quality) migratory barriers may hinder movement of winter steelhead trout between freshwater habitat on federal lands and the ocean. Sport harvest may also impact the number of adults returning to spawn on federal lands.

VI. Summary. The rating reflects three primary considerations: natural history, past actions, and features of the alternative. Although winter steelhead trout are migratory, they are dependent upon high quality freshwater habitat for up to four years. Habitat quality and quantity on federal lands is currently degraded throughout the range of winter steelhead trout. "Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no option will completely recover all degraded aquatic systems within the next 100 years" (FEMAT, V-68). Potential recovery intervals will parallel those of late-successional forest characteristics (possibly up to 200 years). The greater the area in Late-successional and Riparian Reserves, the lower the future risk to habitat. Alternative 9 had less area in LSR than 1, 2, 3, 4, 6, 8, and 10 and reduced Riparian Reserve widths on intermittent streams in non-Key Watersheds than Alternatives 1 and 4. Although possibly at a slower rate than other options, Alternative 9 was considered sufficient to "reverse the trend

of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl" (FEMAT, V-68).

VII. Mitigation. As a result of the review, it was determined that mitigation may improve ratings for winter steelhead trout habitat and are discussed in the following section.

A. Geographic Extent. Throughout the range or limit implementation to 1) areas occupied by identified Evolutionarily Significant Units (ESU) as defined by NMFS; 2) at-risk stocks; or 3) to river basins/provinces characterized by relatively unstable geology and landforms. Since this species is widely distributed throughout its range, mitigation decisions can be made at regional, provincial/basin, or watershed scales.

For mitigation decisions made at a regional planning level, the broader the scope of implementation, the greater the confidence that the measure will successfully reduce risk. If regional scale mitigation decisions are made to target geographic areas smaller than the range, then there are some issues which must be considered: 1) NMFS has not yet identified ESUs for this species; 2) if mitigation is limited to watersheds containing at-risk stocks, then currently healthy populations will receive less protection; and 3) although the data is available, it has not been compiled and analyzed for the region at a sufficiently detailed scale (30 m digital elevation models) to identify unstable watersheds. Relatively unstable provinces/basins may be identified at a regional scale on the basis of generalized stability mapping.

B. Specific Habitats. On federal lands, high quality aquatic and riparian habitat are needed to support the fish species.

C. Mitigation Measures. Although a long-term restoration strategy is necessary, restoration, without other short-term mitigation measures, will be insufficient to decrease risk to habitat. Mitigation measures include: 1) Using Riparian Reserve Scenario 1 on intermittent streams in all watersheds; 2) removing Tier I Key Watersheds from the timber-suitable base; 3) prohibiting new road construction and requiring a net road reduction in Tier I Key Watersheds; and 4) reducing the acreage that is available for harvest by removing inventoried roadless areas from the timber-suitable base.

D. Benefits. The four possible mitigation measures would provide a range of benefits:

1) Application of Riparian Reserve Scenario 1 for all intermittent streams may substantially reduce the risk to habitat especially in coastal areas that "have a large number of at-risk-stocks (V-C), large areas of unstable land (figs V-1 - V-3), and a relatively small proportion of the total area in Key Watershed compared to more inland areas (fig V-25)" (FEMAT). If applied throughout the range of the species, Riparian Reserve Scenario 1 would be the most extensive mitigation suggested and would achieve outcomes for Alternative 9 similar to those for Alternative 4.

2) This mitigation measure would ensure that the system established by Key Watersheds is subjected to limited disturbance from timber harvest and related activities (i.e. road and landing construction). Removal of these areas from the timber-

suitable base is particularly valuable in the short-term since the relatively small amount of high quality habitat remaining is predominantly found in Key Watersheds. This measure strengthens the integrity of the Key Watershed system and directly benefits stocks contained in these watersheds. Key Watersheds will also be dependable sources of individuals to recolonize adjacent watersheds as these recover. Implementation of this mitigation would likely achieve outcomes for this alternative similar to those for Alternative 4.

3) The risk to Key Watersheds would be reduced by prohibiting new road construction and requiring a net road reduction. This mitigation addresses one of the primary impacts of timber harvest activities by reducing the potential for road-related disturbance (i.e. increased sedimentation, increased rates of mass failure, disruption of hydrologic flow patterns). Although the benefit of this mitigation would probably be less than that derived from removing Key Watersheds from the timber-suitable base, it would be valuable.

4) The benefit of this mitigation may be somewhat constrained by the coincidence of roadless areas and watersheds containing habitat for the species, however, approximately 50 percent of all roadless areas are contained in Key Watersheds within the range of the northern spotted owl (FEMAT, Table V-8 p.V-52). Inventoried roadless areas, by definition, tend to be large (5000 acres minimum) with limited disturbance and limited fragmentation. Thus, they frequently contain high quality habitat. Roadless areas are often characterized by significant amounts of unstable land. Removal of these areas from the timber-suitable base would reduce the potential for generating sediment from these erosion- and landslide-prone locations, thereby, reducing the risk to habitat. The benefit of this mitigation may be in excess of the benefits indicated solely by the number of affected acres due to the exceptionally high quality of habitat provided and the percent overlap of roadless areas with Key Watersheds.

The latter two mitigation possibilities could be combined to achieve greater benefits. Removal of inventoried roadless areas from the timber-suitable base in combination with a prohibition on new road construction and required road removal would likely achieve outcomes that are in the range between those of Alternatives 2 and 4.

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Birds

Black-backed woodpecker	J2-452
Common merganser	J2-453

I. **Species.** Black-backed Woodpecker

II. **FEMAT Rating.** 73-27-0-0

III. **Modifications due to changes in Alternative 9.** The changes which occurred to Alternative 9 prior to the additional species analysis would not have resulted in any changes to the FEMAT rating.

IV. **Explanation of Rating.**

A. **Natural History.** The black-backed woodpecker is a relatively uncommon inhabitant of the coniferous forests of the Washington Eastern Cascades, Oregon Eastern Cascades and Klamath provinces. The Klamath province is the southern extension of its range. The bird forages on insect-infested trees in stands of mixed conifer and lodgepole pine at higher elevations.

B. **Past Actions.** "Sanitation cuts" of insect damaged trees may have reduced potential population levels by reducing foraging and nesting opportunities for woodpeckers.

C. **Species Range.** The species is at the southern extension of its range in the planning area (range of northern spotted owl). The center of its range is in Western Canada.

D. **Non-habitat Factors.** No non-habitat factors have been identified which would affect the FEMAT rating.

E. **Inadequate Information.** There are aspects of the species' ecology and its relationship to forest management which could be better understood. However, there is adequate information now available to assess the species.

F. **Features of the Alternative.** Black-backed woodpecker habitat may be degraded by management standards and guidelines which allow salvage and fuels management in the Late-Successional Reserves of Alternative 9. The forest management prescriptions for the matrix could also degrade woodpecker habitat. However, the salvage and fuels management in LSRs is intended to decrease the chances of catastrophic fires. The benefits of reducing catastrophic loss are expected to outweigh the salvage and fuels management effects which could diminish the capacity of Eastern Cascades forests to support woodpeckers.

V. **Cumulative Effects Assessment.** With an estimated 65 percent of its range (within the range of the northern spotted owl) on federal lands and less than 40 percent of that land available for timber harvest, the black-backed woodpecker population in this area should be reasonably responsive to federal land management. As a result, cumulative effects of nonfederal land management should be of minor concern.

VI. Summary. The FEMAT rating reflects the relatively low density distribution of the black-backed woodpecker and the concerns that forest sanitation prescriptions would affect the species distribution and density.

VII. Mitigation. As a result of the review, it was determined that black-backed woodpecker habitat could be improved with mitigations measures, as described below.

A. Geographic Extent. The mitigation would be most effective if applied throughout the range of the species in the planning area.

B. Specific Habitats. The mitigation would be applied to conifer forests with abundant dead trees in Eastern Cascades of Washington, Oregon, and California and the Klamath provinces in Oregon and California.

C. Mitigation Measures. Prescriptions for salvage logging of insect damaged forests in the matrix and LSRs should be specifically designed foraging habitat of this bird. In the situation where large-scale, insect caused tree mortality occurs, any salvage operations should be designed to reduce danger of catastrophic fires and provide appropriate levels of dead/dying trees for woodpecker foraging. In addition, research could be directed to determine appropriate balance between these somewhat conflicting objectives.

V. Benefits. It is expected that application of modified salvage guidelines (as described in the mitigation measure) would raise the rating of Alternative 9 to greater than 80 percent likelihood of providing for a well-distributed population of black-backed woodpeckers on federal lands in the planning area.

I. Species. Common Merganser

II. FEMAT Rating. 100-0-0-0

III. Modification due to changes in Alternative 9. None; the changes which occurred to Alternative 9 prior to the additional species analysis would not have resulted in any changes to the FEMAT rating..

IV. Explanation of Rating.

A. Natural History. The common merganser is associated with larger streams and rivers in forested landscapes during the breeding season. It is a common, widely distributed species primarily associated with low elevations and moderate stream gradients. The bird's breeding habitat is not well represented on federal forest lands; wintering habitat is even less well represented.

B. Past Actions. Low elevation, larger streams and rivers, especially on private lands, are generally in a degraded condition as a result of human encroachment, modification, and pollution.

C. Species Range. The common merganser is widely distributed across the Northern United States and Canada. The range of the northern spotted owl constitutes a minor portion of the common merganser's range.

D. Non-habitat Factor. The bird is hunted (not usually a targeted species), but population loss to hunting is not considered a significant factor in managing the species.

E. Inadequate Information. Adequate information is available to manage for the species and to make judgements of the adequacy of land management alternatives.

F. Features of the Alternative. Because so much of the breeding population is not associated with federal forest lands, specific features of the alternatives will not greatly influence the viability of the species. Late-Successional Reserves and Riparian Reserves are features which enhance stream habitat and water quality, and these features positively influence ratings.

V. Cumulative Effects Assessment. Because such a small proportion of the species breeding population is associated with federal forest lands in the planning area, the influence of conditions on nonfederal lands will predominantly influence the species population.

VI. Summary. The common merganser is a widely distributed, common waterfowl species that is not closely associated with streams and rivers on federal forest lands for breeding or wintering; it is subject to limited hunting pressure.

VII. Mitigation. No mitigation is possible or should be necessary for habitat management on federal forest lands. Habitat management would necessarily focus on nonfederal lands where the bulk of the breeding and wintering population occurs. State and federal agencies responsible for regulating hunting of waterfowl should adequately regulate hunting take and monitor populations to identify habitat management required.

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Bats

Fringed myotis	J2-456
Hoary bat	J2-457
Keen's myotis	J2-459
Long-eared myotis	J2-460
Long-legged myotis	J2-462
Pallid bat	J2-464
Silver-haired bat	J2-465

- I. **Species.** Fringed Myotis (*Myotis thysanodes*)
- II. **FEMAT Rating.** 47-47-5-2
- III. **Modifications due to changes in Alternative 9.** None
- IV. **Explanation of Rating.**

A. Natural History. Occurs in mixed-conifer and mixed-evergreen forests with relatively dry moisture regimes in the Coast Range and southern Cascade Range of Oregon, in scattered localities in the Cascade Range in Washington, and throughout spotted owl range in California. Found from near sea level up to 6,000 ft. This bat is a gleaning species that forages at or within the forest canopy, primarily in riparian habitats. Roost and hibernation sites are generally in crevices occurring in caves, mines, and old wooden bridges and buildings, although snags and large trees also appear to be important. One colony has been found in a fire-scarred redwood in California, and individuals have been found in conifer snags in southern Oregon. Maternity roosts may consist of hundreds of individuals, but in this region, colonies appear to be smaller (30-40 individuals). Generally found in close proximity to mature forests. The fringed myotis is known to have strong site-fidelity, which may make it particularly sensitive to isolation of populations due to forest fragmentation.

B. Past Actions. Timber harvesting activities that involve removal of large snags and decadent trees has eliminated roosting habitat. Disturbance of caves and mines and removal of surrounding vegetation has eliminated hibernation and night roost sites.

C. Species Range. 36 percent of range is on federal land. Of that 36 percent, 29 percent is in the Matrix. Considered a rare species within its restricted elevational range.

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations.

E. Inadequate Information. Additional information is needed for all Pacific Northwest bat species regarding status, geographic distribution, reproductive ecology, and roosting and foraging habits. Recent findings using newly developed radio-telemetry technology indicate that snags and large, decadent trees may be far more important as roost sites for bats than has been previously thought.

F. Features of the Alternative. Primary features are provisions for green-tree retention, late-successional reserves, and riparian buffers to protect foraging habitat.

V. Cumulative Effects Assessment. Cumulative effects may result from loss of snags and large, decadent trees, lack of protection of riparian habitat, loss and fragmentation of forested habitat, or accumulation of pesticides on adjacent non-federal lands.

VI. Summary. This species rated 97 and 87 under outcome A for Alternatives 1 and 3, respectively. The low rating under Alternative 9 appears to be related primarily to differences in prescriptions for snag and green-tree retention within the Matrix, especially in coastal forests, and width of riparian reserves around wetlands and intermittent streams.

Maternity roosts for bats are located at low elevations where climatic regimes do not place excessive energetic demands on lactating females and developing young. Therefore, the lack of retention of green trees in the Matrix in coastal Oregon may eliminate maternity sites. In other areas, if green trees are dispersed throughout the cutting unit, large snags will not be preserved or recruited due to safety concerns.

VII. Mitigation. Mitigation can improve ratings, especially for outcome D.

A. Geographic Extent. Rangewide

B. Specific Habitats.

C. Mitigation Measures. Green-tree retention should be clumped, not scattered, and large snags or decadent trees should be preserved within patches to provide additional roost sites within the Matrix. In addition, buffers around wetlands 1/8 to 1 acre in size should be increased to at least 1 site potential tree or 100 ft along each side of the wetland to protect important foraging habitats.

The Federal Cave Resources Protection Act of 1988 specifies that "Federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves", and defines caves as "any naturally occurring void, cavity, recess, or system of interconnected passages which occur beneath the surface of the earth or within a cliff or ledge (...but not including any...man-made excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or man-made". Conduct surveys of crevices in caves, mines, and old wooden bridges or buildings for the presence of roosting bats. Searches should be conducted during the day in the summer (to locate day roosts and maternity sites), during the late summer and fall at night (to locate night roosts, which are important for reproduction), and during the day in the winter (to locate hibernacula). If bats are found, identify species using the site and determine for what purpose it is being used by bats. Sites containing bats should be protected in accordance with Standards and Guidelines for Cave Management provided in the Deschutes National Forest Plan on pp. 4-31 and 4-32. For sites being used by bats (including caves, mines, and old wooden bridges and buildings), this includes prohibiting timber harvesting within 250 ft of the site, and development of a management plan for the site which would include an inventory and mapping of resources, and plans for protection of the site from vandalism, disturbance from road construction or blasting, and any activity that could change cave temperatures or drainage patterns.

D. Benefits. Application of these mitigations will reduce the risk of local extinctions, and improve the likelihood that well-distributed populations will be maintained within the planning area. Ratings would be increased to levels comparable to those for Alternatives 1 and 3.

I. Species. Hoary Bat (*Lasiurus cinereus*)

II. FEMAT Rating. 53-48-0-0

III. **Modifications due to changes in Alternative 9.** None

IV. **Explanation of Rating.**

A. Natural History. The hoary bat is a solitary bat that roosts only in large, live trees with foliage 3-12 m off the ground. Hoary bats are migratory and are found within the range of the northern spotted owl only during the summer. It is absent from northern Washington and forests near the Columbia Gorge in the Cascade Range. This species is strongly associated with mature forests for both roosting and foraging. Hoary bats eat mainly large moths that are pursued at forest edges in riparian zones or along forested ridges. Only males are known from Washington and Oregon in June and July, indicating that hoary bats do not breed in this region.

B. Past Actions . Harvesting of old-growth forests has eliminated roosting and foraging habitat.

C. Species Range. 39 percent of range is on federal land. Of that 39 percent, 29 percent is in the Matrix. Believed to migrate south as far as southern California or Mexico in the winter.

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations. Conditions on winter range may affect populations in the Pacific Northwest.

E. Inadequate Information. Additional information is needed for all Pacific Northwest bat species regarding status, geographic distribution, and roosting and foraging habits.

F. Features of the Alternative. Primary features are provisions for green-tree retention, late-successional reserves, and riparian buffers to protect foraging habitat.

V. Cumulative Effects Assessment. Cumulative effects may result from lack of protection of riparian habitat, loss of large live trees, loss and fragmentation of forested habitat, and accumulation of pesticides on adjacent non-federal lands.

VI. Summary. This species rated 98, 91, and 83 under outcome A for Alternatives 1, 3, and 4, respectively. The low rating under Alternative 9 appears to be related primarily to differences in prescriptions for green-tree retention within the Matrix, especially in coastal forests, and the width of riparian reserves around wetlands and intermittent streams. Maternity roosts for bats are located at low elevations where climatic regimes do not place excessive energetic demands on lactating females and developing young. Therefore, the lack of retention of green trees in the Matrix in coastal Oregon and on the Mt. Baker/Snoqualmie National Forest may eliminate maternity sites.

VII. Mitigation. Mitigation can improve ratings.

A. Geographic Extent. Rangewide

B. Specific Habitats.

C. Mitigation Measures. Green-tree retention should be clumped, not scattered, and large snags or decadent trees should be preserved within patches to provide

additional roost sites within the Matrix. In addition, buffers around wetlands 1/8 to 1 acre in size should be increased to at least 1 site potential tree or 100 ft along each side of the wetland to protect important foraging habitats.

D. Benefits. Application of these mitigations will reduce the risk of local extinctions, and improve the likelihood that well-distributed populations will be maintained within the planning area. Ratings would be increased to levels comparable to those for Alternatives 1, 3, and 4.

I. Species. Keen's Myotis (*Myotis keenii*)

II. FEMAT Rating. 50-40-5-5

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Very little is known about the natural history of this species. Keen's myotis has the smallest geographic range of any Pacific Northwest bat species. In the U.S., it occurs only in dense, low-elevation forests near Puget Sound and on the Olympic Peninsula in Washington. This range is based on only about 6 records, 2 of which are historic museum records. Natural day roosts are in tree cavities and rock crevices, and maternity roosts are believed to be in cavities in large snags. Hibernation sites are unknown. Keen's myotis appears to be a solitary species. This bat species is rare and probably occurs in low numbers in widely scattered localities.

B. Past Actions. Harvesting of old-growth forests at low elevations around Puget Sound and the Olympic Peninsula in Washington has significantly reduced potential habitat for Keen's myotis.

C. Species Range. This species occurs along coastal areas of Puget Sound and the Olympic Peninsula which were among the first areas where timber harvesting occurred in this region. Most of the distributional range of Keen's myotis is in non-federal ownership. Although the exact geographic range of this species is not well-known, it is likely that only 10-20 percent of its range is in federal ownership. Federal lands occupied by the species include low-elevation areas on the Olympic Peninsula, which under Alternative 9 consist of late-successional reserves or the Olympic Adaptive Management Area.

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations.

E. Inadequate Information. Basic information on biology, ecology, and distribution is almost totally lacking for this species.

F. Features of the Alternative. Primary features are late-successional reserves and the Olympic AMA.

V. Cumulative Effects Assessment. Cumulative effects may result from loss and fragmentation of forested habitat, loss of snags and large, decadent trees, lack of protection of riparian habitat, and accumulation of pesticides on non-federal lands in northwestern Washington. Because a large proportion of the species' range occurs on non-federal lands, this species is especially sensitive to forest management practices occurring outside of federal ownership. Although this species was considered by the panelists to maintain well-distributed populations on federal lands under Alternatives 1 and 3, unless non-federal lands are managed to provide ecological conditions of value to Keen's myotis, the risk of extirpation on federal lands would increase dramatically. Thus, cumulative effects resulting from habitat loss on non-federal lands could reduce ratings <80 percent on federal lands for all Alternatives.

VI. Summary. This species rated 100 and 95 under outcome A for Alternatives 1 and 3, respectively, although cumulative effects resulting from management practices on non-federal lands were not considered in these ratings. The low rating under Alternative 9 appears to be due primarily to perceived losses in habitat quality from management activities expected to occur in the Olympic AMA.

VII. Mitigation. Because our knowledge of this species is so limited, and management plans for the Olympic AMA have not yet been developed, it is unclear how mitigations could be designed to increase the ratings for this species. In addition, it is unlikely that mitigations on federal lands would have a significant effect on the viability of Keen's myotis, given the impact that cumulative effects from habitat loss on non-federal lands may have. We recommend, however, that any management plans within the Olympic AMA be developed in consultation with bat biologists to minimize potential detrimental effects to populations of Keen's myotis. Furthermore, if roost sites or foraging areas for Keen's myotis are located through future research, these areas should be placed within late-successional reserves, with the extent of reserves being determined in consultation with bat biologists on a case by case basis.

I. Species. Long-eared Myotis (*Myotis evotis*)

II. FEMAT Rating. 64-35-1-0

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Occurs in forested habitats up to 9,000 ft elevation. This bat forages by both gleaning and pursuing moths and beetles at the edges of mature forests, especially in riparian zones. Natural roosts are in crevices in caves, mines, snags and trees; hibernation sites are generally in caves and mines. Small water sources, such as ponds in forest clearings appear to be important for this species. The long-eared myotis is a moderately gregarious species. It occurs throughout spotted owl range with the exception of the northern Cascade Range in Washington.

B. Past Actions. Timber harvesting activities that involve removal of large snags and

decadent trees has eliminated roosting habitat. Disturbance of caves and mines and removal of surrounding vegetation has eliminated roost and hibernation sites.

C. Species Range. 40 percent of range is on federal land. Of that 40 percent, 29 percent is in the Matrix.

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations. Bats are sensitive to human disturbance and loud noises especially during hibernation. Cave exploration, or timber-harvesting and road building activities near caves and mines, may result in their abandonment as hibernacula.

E. Inadequate Information. Additional information is needed for all Pacific Northwest bat species regarding status, geographic distribution, reproductive ecology, and roosting and foraging habits. Recent findings using newly developed radio-telemetry technology indicate that snags and large, decadent trees may be far more important as roost sites for bats than has been previously thought.

F. Features of the Alternative. Primary features are provisions for green-tree retention, late-successional reserves, and riparian buffers to protect foraging habitat.

V. Cumulative Effects Assessment. Cumulative effects may result from disturbance of caves, lack of protection of riparian habitat, loss and fragmentation of forested habitat, and accumulation of pesticides on adjacent non-federal lands.

IV. Summary. This species rated 98, 93, and 80 under outcome A for Alternatives 1, 3, and 4, respectively. The low rating under Alternative 9 appears to be related primarily to differences in prescriptions for snag and green-tree retention within the Matrix, especially in coastal forests, and width of riparian reserves around wetlands and intermittent streams. Maternity roosts for bats are located at low elevations where climatic regimes do not place excessive energetic demands on lactating females and developing young. Therefore, the lack of retention of green trees in the Matrix in coastal Oregon may eliminate maternity sites. In other areas, if green trees are dispersed throughout the cutting unit, large snags will not be preserved or recruited due to safety concerns.

VII. Mitigation. Mitigation can improve ratings.

A. Geographic Extent. Rangewide

B. Specific Habitats.

C. Mitigation Measures. Green-tree retention should be clumped, not scattered, and large snags or decadent trees should be preserved within patches to provide additional roost sites within the Matrix. In addition, buffers around wetlands 1/8 to 1 acre in size should be increased to at least 1 site potential tree or 100 ft along each side of the wetland to protect important foraging habitats.

The Federal Cave Resources Protection Act of 1988 specifies that "Federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves", and defines caves as "any naturally occurring void, cavity, recess, or system of interconnected passages which occur beneath the surface of the earth or within a cliff or ledge (...but not including any...man-made excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or

man-made". Conduct surveys of crevices in caves, mines, and old wooden bridges or buildings for the presence of roosting bats. Searches should be conducted during the day in the summer (to locate day roosts and maternity sites), during the late summer and fall at night (to locate night roosts, which are important for reproduction), and during the day in the winter (to locate hibernacula) . If bats are found, identify species using the site and determine for what purpose it is being used by bats. Sites containing bats should be protected in accordance with Standards and Guidelines for Cave Management provided in the Deschutes National Forest Plan on pp. 4-31 and 4-32. For sites being used by bats (including caves, mines, and old wooden bridges and buildings), this includes prohibiting timber harvesting within 250 ft of the site, and development of a management plan for the site which would include an inventory and mapping of resources, and plans for protection of the site from vandalism, disturbance from road construction or blasting, and any activity that could change cave temperatures or drainage patterns.

D. Benefits Application of these mitigations will reduce the risk of local extinctions, and improve the likelihood that well distributed populations will be maintained within the planning area. Ratings would be increased to levels comparable to those for Alternatives 1, 3, and 4.

-
- I. **Species.** Long-legged Myotis (*Myotis volans*)
 - II. **FEMAT Rating.** 55-45-0-0
 - III. **Modifications due to changes in Alternative 9.** None
 - IV. **Explanation of Rating.**

A. Natural History. Occurs in coniferous forest habitats, especially Ponderosa pine forests. This bat is an aerial forager that pursues insects high over the forest canopy, feeding almost exclusively on moths. Spends considerable time foraging in drainages of tributary and intermittent streams. Natural roost sites, including day roosts and maternity roosts are in trees, snags, and rock crevices. Hibernacula and night roosts are caves, mines, and large rock crevices. A moderately gregarious species. Occurs throughout spotted owl range with the exception of the east side of the southern Cascade Range in Washington.

B. Past Actions . Timber harvesting activities that involve removal of large snags and decadent trees has eliminated roosting habitat. Disturbance of caves and mines and removal of surrounding vegetation has eliminated hibernation and night roost sites.

C. Species Range. 43 percent of range is on federal land. Of that 43 percent, 27 percent is in the Matrix.

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations. Bats are sensitive to human disturbance and loud noises, especially during hibernation. Cave exploration, or timber-harvesting and road building

activities near caves and mines, may result in their abandonment as hibernacula.

E. Inadequate Information. Additional information is needed for all Pacific Northwest bat species regarding status, geographic distribution, reproductive ecology, and roosting and foraging habits. Recent findings using newly developed radio-telemetry technology indicate that snags and large, decadent trees may be far more important as roost sites for bats than has been previously thought.

F. Features of the Alternative. Primary features are provisions for green-tree retention, late-successional reserves, and riparian buffers to protect foraging habitat.

V. Cumulative Effects Assessment. Cumulative effects may result from disturbance of caves, loss of snags and large, decadent trees, lack of protection of riparian habitat, loss and fragmentation of forested habitat, and accumulation of pesticides on adjacent non-federal lands.

IV. Summary. This species rated 100, 90, and 83 under outcome A for Alternatives 1, 3, and 4, respectively. The low rating under Alternative 9 appears to be related primarily to differences in prescriptions for snag and green-tree retention within the Matrix, especially in coastal forests, and width of riparian reserves around wetlands and intermittent streams. Maternity roosts for bats are located at low elevations where climatic regimes do not place excessive energetic demands on lactating females and developing young. Therefore, the lack of retention of green trees in the Matrix in coastal Oregon may eliminate maternity sites. In other areas, if green trees are dispersed throughout the cutting unit, large snags will not be preserved or recruited due to safety concerns.

VII. Mitigation Mitigation can improve ratings.

A. Geographic Extent. Rangewide

B. Mitigation Measures. Green-tree retention should be clumped, not scattered, and large snags or decadent trees should be preserved within patches to provide additional roost sites within the Matrix. In addition, buffers around wetlands 1/8 to 1 acre in size should be increased to at least 1 site potential tree or 100 ft along each side of the wetland to protect important foraging habitats.

The Federal Cave Resources Protection Act of 1988 specifies that "Federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves", and defines caves as "any naturally occurring void, cavity, recess, or system of interconnected passages which occur beneath the surface of the earth or within a cliff or ledge (...but not including any...man-made excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or man-made". Conduct surveys of crevices in caves, mines, and old wooden bridges or buildings for the presence of roosting bats. Searches should be conducted during the day in the summer (to locate day roosts and maternity sites), during the late summer and fall at night (to locate night roosts, which are important for reproduction), and during the day in the winter (to locate hibernacula). If bats are found, identify species using the site and determine for what purpose it is being used by bats. Sites containing bats should be protected in accordance with Standards and Guidelines for Cave Management provided in the Deschutes National Forest Plan on pp. 4-31 and 4-32. For sites being used by bats (including caves, mines, and old wooden bridges and buildings), this includes prohibiting timber harvesting within 250 ft of the site, and

development of a management plan for the site which would include an inventory and mapping of resources, and plans for protection of the site from vandalism, disturbance from road construction or blasting, and any activity that could change cave temperatures or drainage patterns.

D. Benefits. Application of these mitigations will reduce the risk of local extinctions, and improve the likelihood that well distributed populations will be maintained within the planning area. Ratings would be increased to levels comparable to those for Alternatives 1, 3, and 4.

I. Species. Pallid Bat (*Antrozous pallidus*)

II. FEMAT Rating. 63-35-3-0

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. Occurs east of Cascade Crest in Washington and Oregon, in the southern Coast Range in Oregon, and throughout spotted owl range in California. Pallid bats are found in dry forests such as mature oak woodlands in California and Ponderosa pine forests in southern Oregon and northern California. They appear to be more abundant in late-successional than in young forests. Natural day and maternity roosts and hibernation sites are in crevices in caves, mines, snags, and broken-top trees. Pallid bats forage widely along riparian zones by pursuing arthropods low to the ground

B. Past Actions. Loss of mature oak woodlands and Ponderosa pine forests and elimination of large snags in southern Oregon and northern California has reduced populations by eliminating roosting and foraging habitat.

C. Species Range. Most of mature oak woodland habitat is on private land, but the species also occurs in dry conifer forests on federal land .

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations.

E. Inadequate Information. Additional information is needed for all Pacific Northwest bat species regarding status, geographic distribution, reproductive ecology, and roosting and foraging habits.

F. Features of the Alternative. Primary features are provisions for snag retention, late-successional reserves, and riparian buffers to protect foraging habitat.

V. Cumulative Effects Assessment. Cumulative effects may result from loss of mature oak woodland and dry coniferous forest habitat, disturbance of caves and mines, and accumulation of pesticides on adjacent non-federal lands.

VI. **Summary.** This species rated 100, 96, and 85 under outcome A for Alternatives 1, 3, and 4, respectively. The low rating under Alternative 9 appears to be related primarily to differences in prescriptions for snag and green-tree retention within the Matrix, especially in coastal forests, and the width of riparian reserves around wetlands and intermittent streams. Maternity roosts for bats are located at low elevations where climatic regimes do not place excessive energetic demands on lactating females and developing young. Therefore, the lack of retention of green trees in the Matrix in coastal Oregon may eliminate maternity sites. In other forests, If green trees are dispersed throughout the cutting unit, large snags will not be preserved or recruited due to safety concerns.

VII. **Mitigation.** Mitigation can improve ratings.

A. **Geographic Extent.** Rangewide

B. **Specific Habitats.**

C. **Mitigation Measures.** Green-tree retention should be clumped, not scattered, and large snags or decadent trees should be preserved within patches to provide additional roost sites within the Matrix. In addition, buffers around wetlands 1/8 to 1 acre in size should be increased to at least 1 site potential tree or 100 ft along each side of the wetland to protect important foraging habitats.

D. **Benefits.** Application of these mitigations will reduce the risk of local extinctions, and improve the likelihood that well-distributed populations will be maintained within the planning area. Ratings would be increased to levels comparable to those for Alternatives 1, 3, and 4.

I. **Species.** Silver-haired Bat (*Lasionycteris noctivagans*)

II. **FEMAT Rating.** 53-48-0-0

III. **Modifications due to changes in Alternative 9.** None

IV. **Explanation of Rating.**

A. **Natural History.** A migratory species that occurs in forests throughout spotted owl range during summer. This species is strongly associated with old-growth forests for both roosting and foraging. All known day and maternity roosts are in crevices in large snags and decadent trees; it rarely enters caves. Maternity colonies are small aggregations of 8-10 females, and most give birth to twins. Silver-haired bats forage by pursuing prey over dense, mature forests near streams and ponds, feeding on a wide variety of arthropods. Known to follow stream corridors when travelling from roosts to foraging sites.

B. **Past Actions.** Harvesting of old-growth forests has eliminated roosting and foraging habitat.

C. **Species Range.** 43 percent of range is on federal land. Of that 43 percent, 27

percent is in the Matrix. Believed to migrate south as far as southern California in the winter.

D. Non-habitat Factors. Pesticide accumulation in insect populations may affect all bat populations. Conditions on winter range may affect populations in the Pacific Northwest.

E. Inadequate Information. Additional information is needed for all Pacific Northwest bat species regarding status, geographic distribution, reproductive ecology, and roosting and foraging habits.

F. Features of the Alternative. Primary features are provisions for green-tree retention, late-successional reserves, and riparian buffers to protect foraging habitat.

V. Cumulative Effects Assessment. Cumulative effects may result from lack of protection of riparian habitat, loss of snags and large, decadent trees, loss and fragmentation of mature forest habitat, and accumulation of pesticides on adjacent non-federal lands.

VI. Summary. This species rated 98 and 91 under outcome A for Alternatives 1 and 3, respectively. The low rating under Alternative 9 appears to be related primarily to differences in prescriptions for snag and green-tree retention within the Matrix, especially in coastal forests, and the width of riparian reserves around wetlands and intermittent streams. Maternity roosts for bats are located at low elevations where climatic regimes do not place excessive energetic demands on lactating females and developing young. Therefore, the lack of retention of green trees in the Matrix in coastal Oregon and on the Mt. Baker/Snoqualmie National Forest may eliminate maternity sites. In other areas, if green trees are dispersed throughout the cutting unit, large snags will not be preserved or recruited due to safety concerns.

VII. Mitigation. Mitigation can improve ratings.

A. Geographic Extent. Rangewide

B. Specific Habitats.

C. Mitigation Measures. Green-tree retention should be clumped, not scattered, and large snags or decadent trees should be preserved within patches to provide additional roost sites within the Matrix. In addition, buffers around wetlands 1/8 to 1 acre in size should be increased to at least 1 site potential tree or 100 ft along each side of the wetland to protect important foraging habitats.

D. Benefits. Application of these mitigations will reduce the risk of local extinctions, and improve the likelihood that well-distributed populations will be maintained within the planning area. Ratings would be increased to levels comparable to those for Alternatives 1 and 3.

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- I. Species. Fisher (*Martes pennanti*)
- II. FEMAT Rating. 63-37-0-0
- III. Modifications due to changes in Alternative 9. None of the modifications to Alternative 9 will have a significant effect on the rating for fisher.
- IV. Explanation of the Rating.

A. Natural History. Very little is known about the habitat relationships of fishers in the Douglas-fir/western hemlock zone. In the Rocky Mountains and in forested areas of Canada and the eastern U.S., fishers occupy a wide variety of forested habitats. Fishers are not dependent upon late-successional forests, but appear to require closed-canopy forests that vary in age as long as they contain adequate prey populations; fishers avoid openings and clearcuts. Consequently, and because they are a wide-ranging species with home ranges on the order of 20 km², fishers are hypothesized to be particularly sensitive to the effects of forest fragmentation.

In the Pacific Northwest, fishers are associated with low and mid-elevation forests in which deep snowpacks do not accumulate. The distributional analysis conducted by Aubry and Houston in Washington showed that west of the Cascade Crest, fisher records are rare above 1,200 m, but that on the east slope, records occur up to 2,000 m in elevation. Forested habitats differ east and west of the crest, but these findings (and those from other regions) strongly suggest that fishers do not fare well where deep snowpacks accumulate. Although sample sizes were small, the majority of fisher records in western Washington were from the western hemlock zone and the majority of records from eastern Washington were from the subalpine fir zone.

Negotiating deep snow is energetically very costly for fishers compared to martens, because of their larger body size and different physical adaptations. Martens are able to effectively pursue prey in deep snow and within the subnivean layer, whereas fishers are not. Thus, there is an elevational stratification of optimal habitat for these two species in the western Cascades: optimal habitat for martens is found at high-elevations where snowpacks form, whereas optimal habitat for fishers occurs at low to mid-elevations where frequent above-freezing temperatures in the winter prevent the accumulation of snow. Martens are more closely associated with late-successional forests than fishers; however, because past timber-harvesting activities in this region have occurred more within the range of optimal habitat for fishers than martens, the widespread harvesting of old-growth forests has had a significantly greater impact on fishers than on martens. In addition, trapping seasons for fishers in both Oregon and Washington were closed in the 1930's, indicating that populations had been overharvested in the early part of this century. Thus, marten populations throughout the Cascade Range are generally considered to be healthy, whereas fishers remain rare even after 60 yr of protection from trapping.

Besides a continuous canopy, fishers also prefer forests that have complex physical structure near the forest floor. This structure is important for maintaining prey populations and for providing access to prey during the winter, especially when snow is on the ground. In addition, fishers have very narrow habitat requirements for natal den sites: all natal dens ever found for fishers (and this number is less than 50, rangewide), were located in cavities in trees or snags at heights generally exceeding 6 m. Clearly, only relatively large trees or snags will serve as natal dens: the mean dbh of 32 natal den sites found in Maine was 51 cm. Because a female fisher raises her young alone, and must leave the kits to secure prey for herself and for them, it is believed that such sites are necessary for protecting the kits from predators when they are very young. This rather restrictive habitat requirement may have contributed to the decline of fishers in the Pacific Northwest, since the conversion of old-growth Douglas-fir forests to young, even-aged plantations results in the elimination of potential natal den sites.

Thus, fisher populations are believed to have declined on Federal lands within the range of the northern spotted owl for two primary reasons, both of which are related to the widespread conversion of old-growth Douglas-fir forests to young plantations: loss of habitat due to forest fragmentation resulting from clearcutting designed in a staggered-setting prescription, and the removal of large, downed coarse woody debris and snags from the cutting units.

B. Past Actions. Habitat has been impacted and fragmented by previous forest management, and the species has been extirpated from significant portions of its historical range. Recolonization of significant parts of its previous range is not likely over the short term.

C. Species Range. The historical range of the fisher probably included most of the Pacific Northwest within the range of the northern spotted owl; however, the present known range of the species includes extreme northern California and southern Oregon, the Olympic Peninsula, and north-central and northeastern Washington. The range of the species (within that of the northern spotted owl) includes over 20 million acres of which 66 percent is on federal lands.

D. Non-habitat Factors. Incidental trapping and poisoning of other predatory mammals may have had an influence on fisher populations, but there is no information on these concerns. They tend to be shy and secretive, so human disturbance may influence their distribution and abundance.

E. Inadequate Information. There is very little known about the habitat relationships of fishers in the Pacific Northwest, and this influenced the viability ratings by the panelists. For example, a recent conservation status review lists only 10 articles on fisher in the Pacific Northwest, and most of these are unpublished reports or pertain to the population status of the species. Information on abundance, habitat associations, and population ecology of the species in the Pacific Northwest is lacking. Because of the disjunct nature of their populations, information on genetic variation in fisher populations is urgently needed.

F. Features of the Alternative. Alternatives 1 and 3 that contained Riparian Reserve Scenario 1 or guidelines for increased retention of coarse woody debris were rated higher than Alternative 9. Many known locations for the species are outside the late-successional reserves, and it is possible that harvest of such forest may cause local extirpation of populations. Fishers failed to pass the screens largely because of concern that inadequate provisions are included in Alternative 9 for significantly reducing regional levels of forest fragmentation in the short term and concern that guidelines will not provide adequate amounts of both snags and decadent trees for natal den sites, and downed woody debris for foraging habitat within the Matrix. Fishers rated >80 under Outcome A for Alternatives 1 and 3, which were perceived to provide adequate amounts of these habitat features.

V. Cumulative Effects Assessment. Fishers are naturally rare, have a disjunct distribution in the Pacific Northwest, and apparently are slow to recolonize areas after local extirpation. The species is usually associated with lower elevations where there are lower amounts and poorer distribution of federal lands. The species' range includes approximately 21 million acres of which 66 percent is federal land, and 62 percent of federal lands would be in Late-Successional Reserves (27 percent) or Congressionally Withdrawn Areas (35 percent) under Alternative 9. There is also a lack of information on the ecology of fishers in this region. Because of these cumulative effects, it is doubtful whether the amount and distribution on late-successional forest will be sufficient to maintain populations that are well-distributed throughout the species' range under any of the Alternatives. These perceived risks can be mitigated in part by obtaining more information on the distribution, abundance, and habitat relationships of the species, and by changing forest management in the matrix between the reserves.

VI. Summary. The rating reflects the rareness and disjunct distribution of fishers and the lack of information on the species in the Pacific Northwest. There is also concern for the species in highly fragmented forests where most of the landscape is composed of very young forests; this applies to the forest matrix outside of the reserves and non-federal lands, especially at lower elevations. The species' range includes 34 percent non-federal land. Although we may be able to provide suitable habitat that is well-distributed on federal lands, fisher populations may never respond and be well distributed because of (1) their apparently low rates of recolonization of restored habitats after local extirpation, (2) the lower amounts of federal land at lower elevations, and (3) their natural rareness. Consequently, outcome B may be as good an outcome for populations as can be expected for this species under any of the Alternatives.

VII. Mitigation. Mitigation can improve habitat conditions for fishers.

A. Geographic Extent. Entire range of fisher

B. Specific Habitats. The size and distribution of patches of late-successional forest and provision of large-diameter (> 20 inches dbh) standing and fallen coarse woody debris are key habitat features.

C. Mitigation Measures. Implementing mitigations that would substantially reduce levels of forest fragmentation and increase amounts of downed, coarse woody debris

in the Matrix are expected to raise the score for fisher habitat under Alternative 9 to levels comparable to those of Alternatives 1 or 3. There are two combinations of mitigations that will accomplish this: Provision of increased levels of coarse woody debris in the Matrix (generally 6 to 10 logs per acre greater than 20 inches diameter) AND either (1) implement landscape management controls in the Matrix (such as 50-11-40) OR (2) provide dispersed large patches of late-successional forest (such as residual habitat areas for spotted owl nest sites). These additional provisions for snags and late-successional forest will provide denning sites and suitable habitat in the Matrix, which will reduce the chance of local extirpation of any populations in the short term. Other mitigations that will be of benefit to fishers include surveying to locate additional populations, and increased Riparian Reserve widths along intermittent streams. Although not part of the management provisions of these Alternatives, translocation of fishers to areas where they once occurred should be considered.

D. Benefits of Mitigation. The projected benefits of these mitigations will likely be different for habitat versus populations for fishers. For Alternative 9, we expect the above mitigations to increase the likelihood of achieving outcome A to levels comparable to those of Alternatives 1 and 3. Alternative 9 with mitigations will provide better habitat in the Matrix; therefore, we expect habitat for the species to be well-distributed on federal lands. However, because of the above cumulative effects we do not expect populations of the species to be well distributed under any of the Alternatives. Fisher populations are likely to continue to be rare and have disjunct distributions, and outcome B may be as good as we can expect in the future.

I. Species. American Marten (*Martes americana*)

II. FEMAT Rating. 67-27-3-3

III. Modifications due to changes in Alternative 9. None of the modifications to Alternative 9 will have a significant effect on the rating for martens.

IV. Explanation of Rating.

A. Natural History. American martens are more abundant and more widely distributed than fishers in the Pacific Northwest, and more information is available on their habitat requirements and population status. Key habitat features are downed coarse woody debris of various decay stages to support prey (primarily *Clethrionomys* and *Tamiasciurus*), large patches of late-successional forest, and intact forest along riparian zones. Martens preferentially select resting sites in large-diameter trees near streams.

Martens are relatively abundant in the Cascades of Washington and Oregon, but they are infrequent in the Olympic Peninsula and in the coastal regions of Washington, Oregon, and California. Martens are well-adapted to high-elevation conditions, and the lower elevations of coastal portions of these states may never have supported high

densities compared to fishers. Populations in the Cascade Range are densest in the true fir zone, which generally occurs above 1,200 m. Because marten populations are large and well-distributed in this region, they may respond more quickly than fishers to habitat restoration. Marten populations are expected to respond as cutover forest within reserves attains late-successional conditions over the next 100 years.

B. Past Actions. Past forest management practices that have resulted in fragmentation and conversion of late-successional forests to young even-aged forests have likely affected numbers of this species.

C. Species Range. The American marten is distributed throughout the boreal forest zone of North America. Its range within that of the northern spotted owl includes over 21 million acres of which 65 percent is federal land. One subspecies, the Humboldt marten (*Martes americana humboldtensis*) occurs only in northwestern California.

D. Non-habitat Factors. Trapping of martens is allowed in Oregon and Washington, but this does not seem to have resulted in population decline. Disease may be a significant cause of mortality, but causes of disease outbreaks are not understood.

E. Inadequate Information. The American marten is among the better known mammalian carnivores, but relatively little is known about their habitat relationships and population status in the Pacific Northwest. Four graduate student theses have been completed on the species at Sagehen Creek in the Sierra Nevada, but relatively little work has been done on marten ecology in Washington and Oregon. Information on demographic trends is lacking and regional surveys to determine distribution on federal lands have not been undertaken. This lack of information was partly responsible for the low ratings by the panelists.

F. Features of the Alternative. The alternatives that contained the Riparian Reserve Scenario 1 guidelines for riparian buffers, and guidelines that would leave snags and downed wood above levels of many forest plans were rated higher than Alternative 9. Martens preferentially use riparian habitats for foraging and resting, they rely on standing snags for maternal dens, and they prey on small mammals that are associated with downed dead wood.

V. Cumulative Effects Assessment. The range of the marten includes approximately 21 million acres of which 65 percent is on federal lands; 67 percent of all federal lands would be in late-successional reserves (27 percent) or congressionally reserved (40 percent) lands under Alternative 9. The amount and distribution of reserves on federal lands appears to be sufficient to provide for well-distributed populations on most federal lands. However, populations in the Oregon Coast Range and Olympic Peninsula are extremely low. There is also a paucity of information on the general ecology of the species in the Pacific Northwest. These other factors tend to increase the risk of local extirpation of the species in parts of its range, but this increased risk is difficult to quantify. The perceived risks can be mitigated to some extent by acquiring more information on the species' ecology and by changing forest management practices in the forest matrix on federal lands.

VI. **Summary.** The American marten failed the screen primarily because habitat conditions in the Matrix would not provide adequate amounts of foraging and denning habitat, especially over the short run until habitat conditions achieve late-successional status within reserved areas. Alternatives that provided greater levels of coarse woody debris or wider riparian reserves received higher ratings than those of Alternative 9. Because of historically low population numbers in coastal and other low-elevation areas of Oregon and Washington, there was concern that outcome A may not occur throughout the entire range of the species.

VII. **Mitigation.** Mitigation can improve habitat conditions for marten.

A. **Geographic Extent.** Entire range

B. **Specific Habitats.** Large-diameter (> 20 inches) standing snags and downed wood; late-successional forest in proximity to permanently flowing and intermittent streams.

C. **Mitigation Measures.** American martens use riparian areas for foraging and for selection of resting sites in large trees or large woody debris. Downed wood is also used for foraging and protection from cold weather during the winter. The network of Riparian Reserves and Key Watersheds in Alternative 9 of FEMAT will provide habitat in addition to the late-successional reserves. They will also provide connectivity between the reserves. Guidelines for management of marbled murrelet habitat in the Coast Range of Oregon and the Olympic Peninsula of Washington will also provide benefits to martens. However, additional protection is needed for marten habitat to help ensure the establishment of well-distributed populations on federal lands in the Pacific Northwest. Primary mitigation for this species is a combination of increased levels of coarse woody debris in the Matrix and implementation of Riparian Reserve Scenario 1 throughout the species range. Because the ranges of marten and at-risk fish stocks are largely coincident, riparian protection within the ranges of these fish is sufficient to achieve desired objectives for the marten. In addition, the National Forests and BLM Districts should conduct more thorough surveys for martens throughout their lands. More information on the distribution, abundance, and habitat relationships of martens throughout their range is needed to provide better management guidelines.

D. **Benefits.** Implementation of this combination of mitigations (increased riparian reserve width and increased retention of coarse woody debris) will result in ratings similar to those of Alternative 1, whereby habitat conditions would be sufficient to support a stable, well-distributed population throughout most of its range. However, marten populations are low in the Olympic Peninsula and the Oregon Coast Range, and there is some chance that populations may not recover in those provinces despite the more favorable habitat conditions that would result from these mitigations.

I. **Species.** Oregon Red Tree Vole (*Phenacomys longicaudus*)

II. **FEMAT Rating.** 73-25-2-0

III. Modifications due to changes in Alternative 9. None

IV. Explanation of Rating.

A. Natural History. The Oregon red tree vole is unique among mammals in that it spends most of its life in the canopy of coniferous trees and eats needles of conifer trees. The red tree vole is more abundant in late-successional forest than young forest, and appears to be closely associated with older forests. Because they are small and live almost exclusively in the canopy of conifers, they probably have limited dispersal capabilities.

B. Past Actions. Past forest management practices have resulted in fragmentation and conversion of late-successional forests to young, even-aged forests, and these practices are believed to have reduced numbers of red tree voles.

C. Species Range. The red tree vole, Phenacomys longicaudus, occurs only in the Cascade and Coast Ranges of western Oregon. Its range includes over 13 million acres, 35 percent on federal land. One subspecies, P. l. silvicolus, occurs only in the northern portion of the Oregon Coast Range and primarily on non-federal land.

D. Non-habitat Factors. None

E. Inadequate Information. Because red tree voles spend most of their lives in the forest canopy, they are extremely difficult to study. Consequently, abundance, habitat associations, and population ecology of the species is not well understood. Lack of information on dispersal capabilities and abundance in young forests was of concern to the panelists.

F. Features of the Alternative. Each late-successional reserve will likely support large populations of red tree voles, but each of these populations may be isolated from other such populations. Connectivity of late-successional reserves by blocks or corridors of older forests may be necessary to provide small breeding colonies between large reserves to facilitate gene flow from one reserve to another.

V. Cumulative Effects Assessment. The only cumulative effects that may impact viability of red tree voles in Oregon is the amount and distribution of federal and non-federal lands within the species range; no other factors are known to affect the species' populations. The species occupies approximately 13 million acres of which 35 percent is federal land, and 50 percent of the species' range on federal lands would be in Late-Successional Reserves (40 percent) or Congressionally Withdrawn Areas (10 percent) under Alternative 9. The distribution of these reserves includes most of the species' range except the northern Coast Range of Oregon. Therefore, federal lands will likely provide for large, well-distributed populations of the species, except possibly in the northern Coast Range of Oregon. Because of the limited dispersal capabilities of the species and its low abundance in young forests, connectivity of populations in reserves is of concern. This perceived risk can be mitigated by assessing abundance of red tree voles in young forests and their dispersal capabilities and/or by changing forest management practices in the Matrix between Late-Successional Reserves.

VI. **Summary.** The slightly low rating for red tree voles was partially a result of poor information on abundance, distribution, and dispersal capabilities. Available information suggests the species has limited dispersal capability. In areas of the Matrix that will not currently have patches of late-successional forest protected within riparian reserves or other reserves, colonies may become genetically isolated, resulting in the assigned likelihood of outcome B.

VII. **Mitigation.** Mitigation can improve habitat conditions for red tree voles.

A. **Geographic Extent.** Entire range of the species.

B. **Specific Habitats.** None

C. **Mitigation Measures.** The red tree vole, Phenacomys longicaudus, is most abundant in late-successional forests, so their populations are likely to be sparse in the forest matrix between reserves in the future. The species also has limited dispersal capabilities, so forest fragmentation may also limit connectivity between populations in reserves. The Riparian Reserves will provide some connectivity between Late-Successional Reserves and other reserves. Implementing mitigations that would reduce levels of forest fragmentation and provide dispersal corridors for red tree voles, and identify and protect occupied sites will improve the likelihood of Outcome A. There are two combinations of mitigations that will accomplish this: Survey and manage known breeding colonies in the Matrix AND either (1) implement Riparian Reserve Scenario 1 OR (2) implement additional landscape controls within the Matrix such as the 50-11-40 rule. Other mitigations that will be of benefit to conservation of red tree voles, but not play a significant role in increasing its score include surveying to acquire additional information, reserving the oldest and largest green trees in prescriptions for green-tree retention, and protection of additional old-growth and late-successional forest.

D. **Benefits of Mitigation.** The above mitigations will provide better habitat in the forest matrix in the short term until habitat conditions within the Late-Successional and Riparian Reserves achieve late-successional condition. Additional research will provide better information to guide management of the species. Such measures are likely to improve breeding and dispersal habitat for the species throughout its range and increase the likelihood of achieving outcome A to >80 percent under Alternative 9. This prediction is based the fact that the species was rated >80 percent likelihood of achieving outcome A under Alternatives 1, 3, 4, and 5 of FEMAT, and the rating for Alternative 9 was close to this level. In fact, we believe the Late-Successional Reserves will support large populations, and connectivity between reserves will be provided by the Riparian Reserves, and the additional late-successional patches in the matrix.

I. **Species.** California Red Tree Vole (*Phenacomys pomio*)

II. FEMAT Rating. 78-23-0-0

The California red tree vole failed to pass the screens by a very narrow margin; it was given a likelihood of 78 in Outcome A and 0 for outcome D. The rating was as high as 100 for Alternative 1 and ranged from 88 to 95 in all Alternatives except 7, 8, and 9. The primary reason for the lower rating in Alternative 9 was concern about retention of sufficient late-successional forest in the Matrix, uncertainty about the species distribution and habitat requirements, and the fact that only about 22 percent of the species range is on federal land. Given the very small margin by which this species failed the screen, our subsequent review of the panel notes, new research findings which indicate that this species nests in later classes of early-successional forest, and our close examination of the distribution of reserved lands and Key Watersheds in California, we do not find support for the need to further mitigate to meet the screening criteria under Alternative 9. Although nonfederal management will strongly affect the species' rangewide distribution, home range sizes for this species are small, and large areas of suitable habitat will be available on the federal portion of the species' range. Therefore, no specific mitigations are proposed. We note, however, that mitigations proposed for other species will further increase the likelihood that habitat conditions will be sufficient to meet this species' requirements.